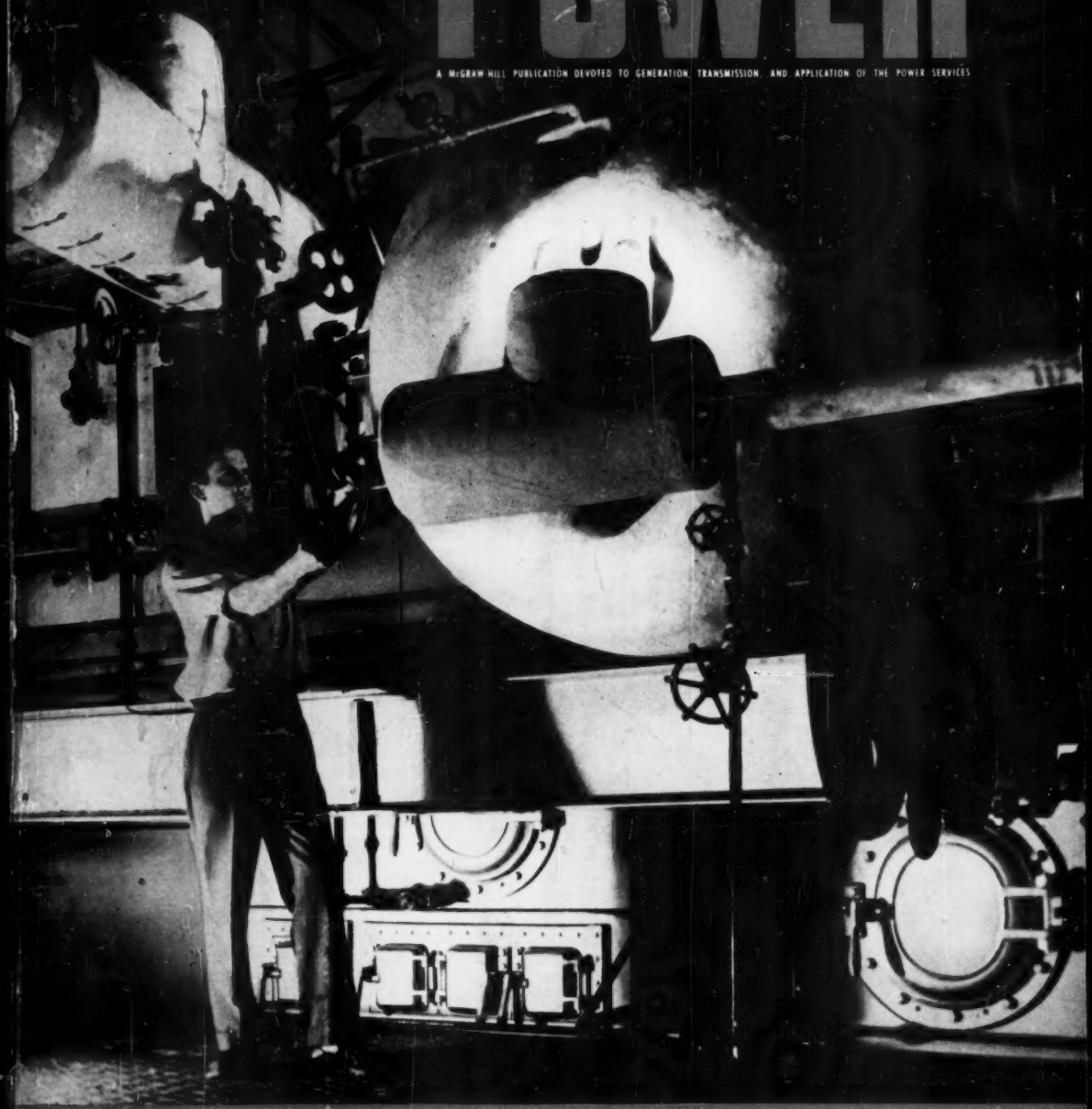
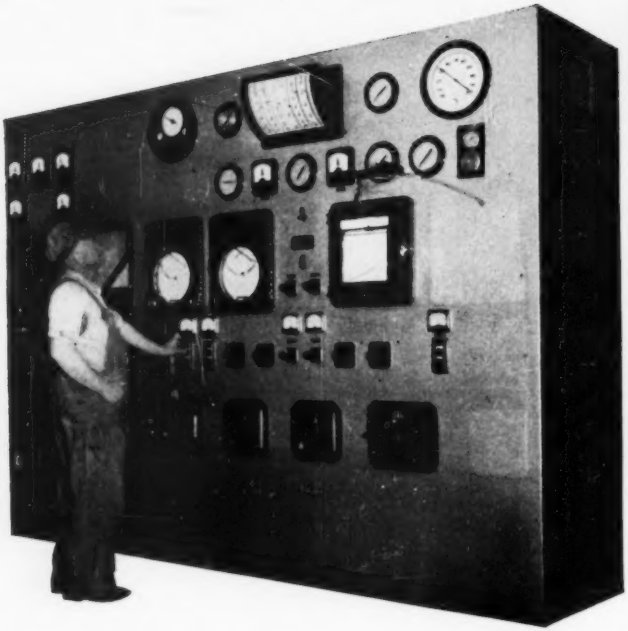
JANUARY 1949

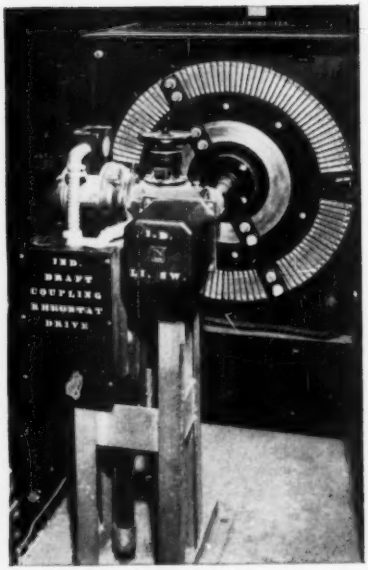
POWER

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION, AND APPLICATION OF THE POWER SERVICES



IN THIS ISSUE: Practical suggestions on a little discussed problem — design of river pumphouses, p 68; first details of recovery boilers for burning waste sulphite liquor to make steam, reclaim chemicals and eliminate disposal difficulties, p 100; how incendiary-bomb material kindles stoker fires faster, p 73. **CONTENTS, p 59**





Metermax valve drive coupled to rheostat of a fan's magnetic coupling at Grand Ave. Station, Kansas City Power & Light Co., Kansas City, Mo.

Big Boiler Handles Load Swings Efficiently With METERMAX Controlling Combustion

Keeping the equipment that generates hundreds of thousands of pounds of high-pressure steam per hour operating at top efficiency is a job that calls for constant, accurate, highly-skilled attention.

To reduce routine operating duties, while maintaining full accuracy of regulation, Kansas City Power & Light has handed to the Metermax panel shown above the job of controlling the boiler that absorbs the load swings for their output of 1,300,000 pounds per hour.

Five other boilers carry the base load, but the 350,000 pound unit controlled by Metermax does the regulating job. And Metermax keeps it operating at top efficiency continuously.

The drive unit pictured above is just one example of the simplicity of design that contributes so much to Metermax's dependability. A small flexible coupling connects the drive unit to the rheostat that regulates exciting current to the magnetic coupling for the induced draft fan. There is no complicated mechanical linkage to give operating or maintenance difficulties.

The instruments shown here have now been in operation for several years, and the station engineers are so well satisfied with results that two more boilers will soon be operating under Metermax Control.

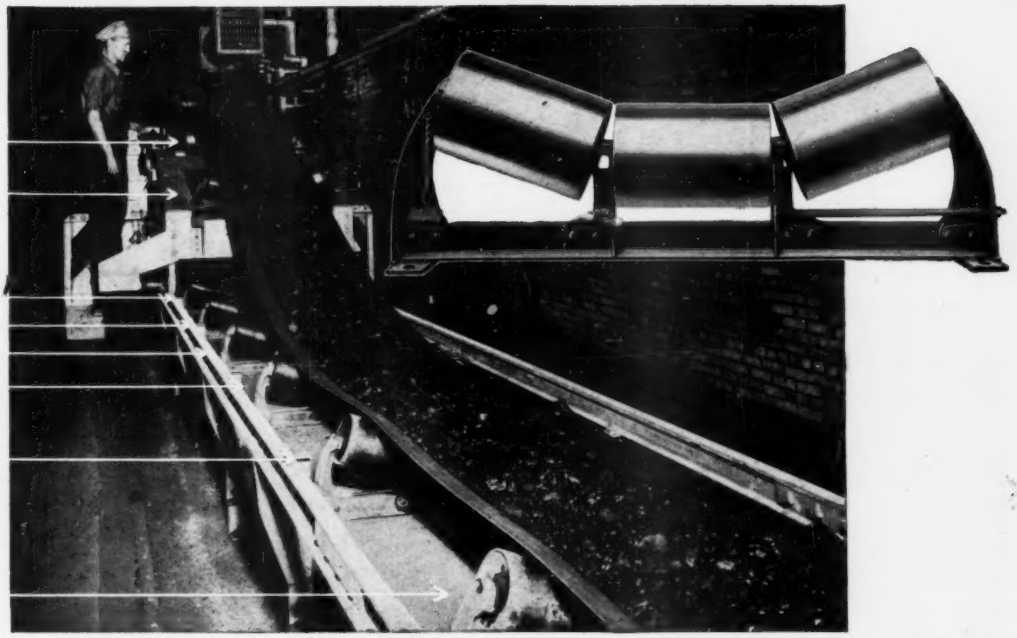
For further information, write for Catalog ND64-01-463, or ask specific questions about the power plant you are interested in. Leeds & Northrup Co., 4910 Stenton Ave., Philadelphia 44, Pa.

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl. Ad N-01-463(2)

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer" and "The Stationary Engineer", January, 1949, Vol. 93, No. 1. Published monthly with an additional Directory number in June. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. Subscription rates—U. S. and U. S. Possessions $5 for one year, $7 for two years, 50c per copy. Canada $6 for one year, $9 for two years. Pan American Countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years. Please indicate position and company connection on all subscription orders.



Link-Belt Standardized Design Cuts Belt Conveying Costs

In the Link-Belt "100" series belt conveyor idlers, we believe that we have achieved the ultimate in design and performance, with evolution of engineering features progressively since 1896. These features cut conveying costs by reducing maintenance, giving longer service, and permitting the greatest simplification.

In addition to idlers, Link-Belt builds a great variety of standardized design conveyor elements and accessories such as: belt and apron feeders for uniform loading; trippers for intermediate discharge or distribution; drives using gears, reducers and chains; terminal machinery; supporting structures and enclosures.

We are at your service for complete conveyor systems, or individual equipment, to suit your requirements.

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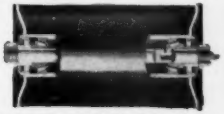
11,212

LINK-BELT

BELT CONVEYOR EQUIPMENT

IDLERS • TRIPPERS • BELTS • PULLEYS • BEARINGS • DRIVES

Grease-in—Dirt-out Seal prevents harmful foreign matter from reaching bearings — conserves lubricant — prolongs bearing life.



Rolls made with smooth rounded-edge outer shell of uniform thickness, and a full-length steel central tube, both continuous-welded to dished steel heads to form sturdy, well-balanced integral units.

Strong Brackets Support the Rolls

Supporting brackets are tough malleable iron in reinforced T-section to withstand load and impact.

Interlocking Nuts and Yokes Prevent Brackets from Spreading

Impact Idlers with Rubber Treads

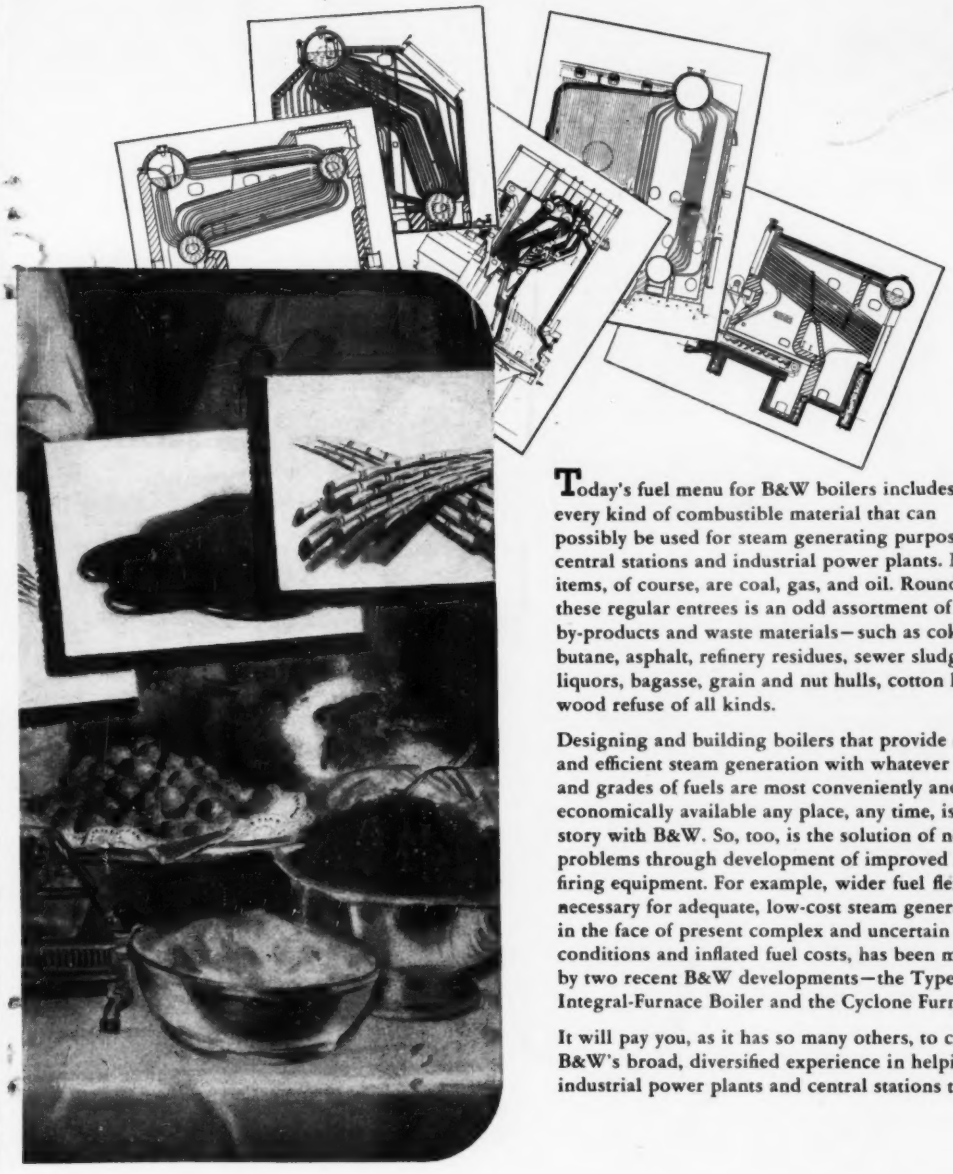
Interchangeable with steel rolls this type provides a Cushion at loading points to protect idlers and preserve the belt — A good investment where heavy lump materials are handled.

Smörgåsbord for boilers...

***STEAM** that*

THE BABCOCK & WILCOX CO. *GENERAL OFFICES: 85 LIBERTY ST., NEW*

FOR POWER PLANTS — B&W, Open-Pass, Radiant, Integral-Furnace, Cross-Drum, Stirling and Waste-Heat Stationary Boilers . . . Air Heaters . . . Economizers . . . Superheaters . . . Water-Cooled Furnaces . . . Oil, Gas & Multifuel Burners . . . Chain-Grate Stokers . . . Stacks and Breechings



Today's fuel menu for B&W boilers includes about every kind of combustible material that can possibly be used for steam generating purposes in central stations and industrial power plants. Most popular items, of course, are coal, gas, and oil. Rounding out these regular entrees is an odd assortment of by-products and waste materials—such as coke breeze, butane, asphalt, refinery residues, sewer sludge, paper mill liquors, bagasse, grain and nut hulls, cotton lint, and wood refuse of all kinds.

Designing and building boilers that provide dependable and efficient steam generation with whatever types and grades of fuels are most conveniently and economically available any place, any time, is an old story with B&W. So, too, is the solution of new fuel problems through development of improved boilers and firing equipment. For example, wider fuel flexibility, so necessary for adequate, low-cost steam generation in the face of present complex and uncertain fuel conditions and inflated fuel costs, has been made possible by two recent B&W developments—the Type FH Integral-Furnace Boiler and the Cyclone Furnace.

It will pay you, as it has so many others, to call on B&W's broad, diversified experience in helping industrial power plants and central stations to obtain—

G-419 T

satisfies . . . with any fuel or firing method

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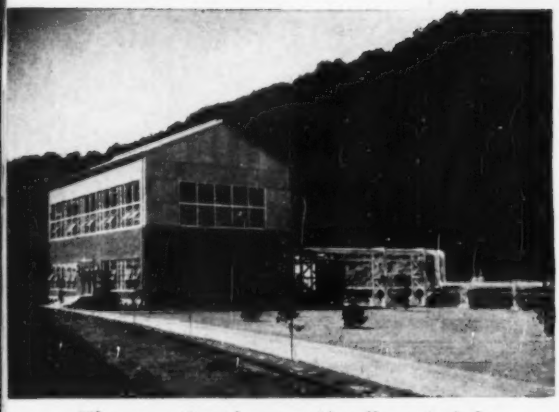
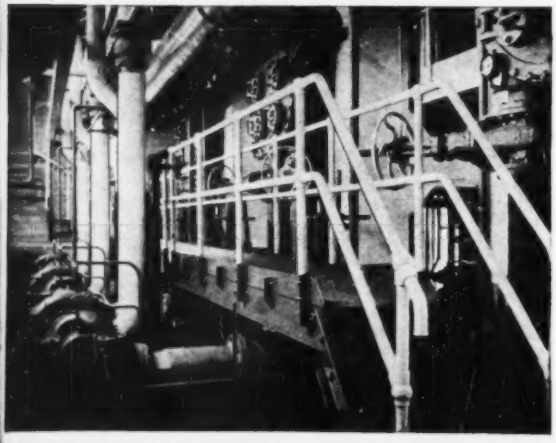


The generating plant provides all required electric power in an isolated location.

Elliott condensers serve main turbines. Circulating and condensate pumps driven by Elliott turbines.



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Elliott

Anniversary Station

THIS LINE OF THREE ELLIOTT 1500-kw

straight condensing turbine-generator units went into service a few months ago at the Hastings, W. Va. compressor station of the Hope Natural Gas Company, — just as the Company celebrated its 50th anniversary.

The three Elliott turbines are served by Elliott condensers. (Numerous Elliott mechanical drive turbines and three deaerating feedwater heaters are used in the generating station, boiler plant and natural gasoline plant.)

These units provide power for motor-driven auxiliaries in the boiler house and the compressor station, for motors in the water pumping house and in the gasoline plant, and the lighting load.

The new generating plant is the climax of a modernization program which permits the company to start its second half-century with completely up-to-date and enlarged facilities. The installation is a fine example of the type of thinking which keeps operating costs to the present-day minimum by the use of new and modern equipment.

H-722

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Steam Turbine Dept.
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Plants at: JEANNETTE, PA. • RIDGWAY, PA.
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DIAMOND

Simplicity

IN YOUR SOOT BLOWERS MEANS

More Dependable Operation

Lower Maintenance Costs

SIMPLICITY... not for its own sake but because it results in improved and more dependable operation . . . and in substantially reduced maintenance costs.

SIMPLICITY has always been a major consideration in the design and development of all types of Diamond Soot Blowers . . . whether permanently installed or retracting . . . whether steam or air is the cleaning medium . . . whether manual or automatic operation.

An example of this Diamond Simplicity is in the design and operation of the short retracting soot blower shown below. Many of the parts are interchangeable with the popular Diamond G9B Soot Blower. Instead of using one air motor for projecting and retracting the nozzle and another for rotation while blowing, only a single air motor is used for all operations. The same practice of using a single motor for both retraction and rotation is followed on the long retracting blowers.

Simplicity is one of the important reasons why Diamond Soot Blowers are so generally preferred by engineers responsible for the selection of equipment for central stations—where requirements are most severe. Ask for a copy of Catalog 1014 to see the many other reasons.

DIAMOND
Short Retracting Blower
(MODEL 18)

For cleaning furnace walls or boiler heating surfaces where gas temperatures exceed limit for permanently installed units. Positive poppet type valve prevents leakage and flow until nozzle is in blowing position . . . minimizing possibility of cutting wall box, nozzle and water wall tubes. The 12 inch travel removes nozzle far enough from furnace heat to eliminate air cooling. Lubrication unnecessary. Compact and few working parts. Widely spread bearing surfaces and easily accessible packing. Adjustable pressure control. Uses either air or steam as cleaning medium. Air, electric or manual operation.

DIAMOND POWER SPECIALTY CORP.
DETROIT 31, MICHIGAN
DIAMOND SPECIALTY LIMITED—Windsor, Ontario

for EVERY

Yarway Type "B" angle-straightway Seatless Tandem Valve with balanced sliding plungers. Flanged, steel body.

Yarway Type "C" angle-straightway Seatless Tandem Valve with balanced sliding plungers. Flanged, steel body.

THERE'S A YARWAY BLOW-OFF VALVE

Yarway offers boiler plant operators a complete Blow-Off Valve Service—distinct types of valves to meet the blow-down requirements of every steam plant.

These valves are the products of 40 years mechanical and metallurgical research—of practical field experience with thousands of installations—of experiments and testing in Yarway's own unique Steam Laboratory—and of a determination continually to lead the industry with the finest blow-down equipment that can be produced.

Because the Yarway line is complete you may be sure Yarway recommendations are based on experienced judgment that the type of valve selected will give long, trouble-free, money-saving service.

WRITE TO YARWAY FOR FREE BLOW-OFF VALVE BULLETINS. STATE YOUR BOILER PRESSURE.

YARNALL-WARING COMPANY
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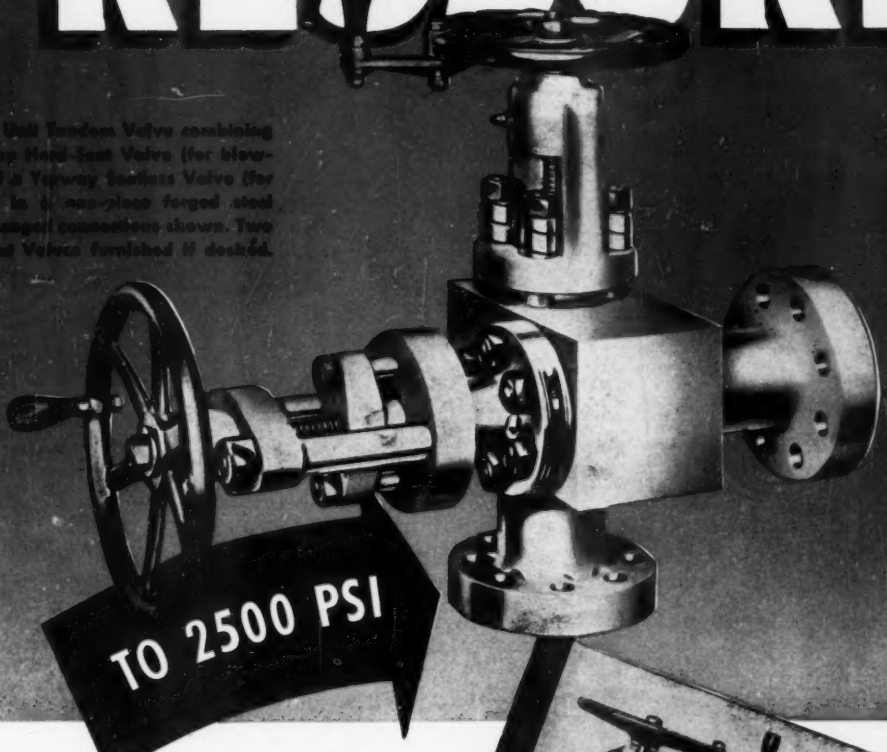
YARWAY BLOW-OFF

PRESSURE



Yarway Unit Tandem Valve combining a Yarway Hard-Seat Valve (for blowing) and a Yarway Seatless Valve (for cooling) in a one-piece forged steel body. Flanged connections shown. Two Hard-Seat Valves furnished if desired.

TO 2500 PSI

A Few Representative Users

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Forty Years SERVICE 1908 1948 TO STEAM PLANTS

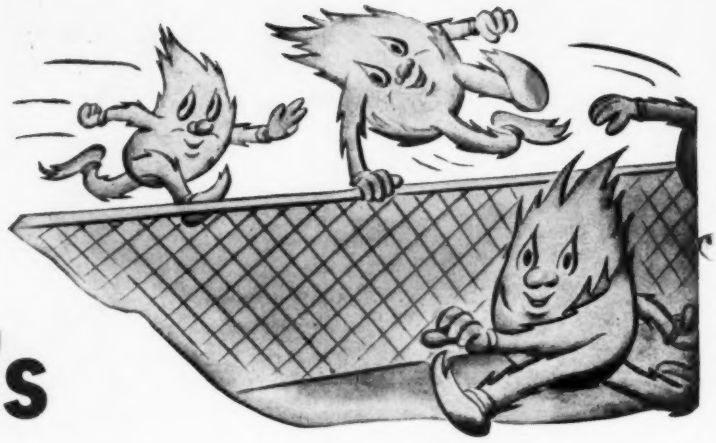
YARWAY SEATLESS ANGLE VALVE

Cross section of valve in open position. Notice balanced sliding plunger design. Plunger is nitrided steel, extremely wear-resistant.

YARWAY HARD-SEAT STRAIGHTWAY VALVE

Cross section of valve in open position. Stellited disc and seat. A worthy companion to the Yarway Seatless Valve for tandem use on higher pressure.

VALVES



Btu's

Every fuel has a large percentage of Btu's ready to "go over the fence". They do no work. They produce no power. The more you can keep on the job—the lower your power costs will be. And that is exactly what the Bailey co-ordinated boiler control system can do for you.

It reduces fuel consumption per pound of steam generated. Combustion, feed water, steam temperature, heater levels, pump speeds and all other factors are co-ordinated—automatically controlled. With Bailey Controls safety of operation is increased—continuity of service is improved. You convert the maximum number of Btu's into power. You get full efficiency from your boiler.

Many Bailey co-ordinated boiler control systems have paid for themselves in fuel saved in less than one year. All do not return their original cost as quickly as this. But the quick way to find out how Bailey boiler control will work for you is to talk to one of our engineers. Bailey co-ordinated boiler control is not a package unit. Each must be engineered to the specific job.

If you are looking for low cost power, it will pay you to call our nearest office.

A-105-1

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BAILEY METER COMPANY LIMITED, MONTREAL, CANADA

Controls for Steam Plants
COMBUSTION • FEED WATER • TEMPERATURE
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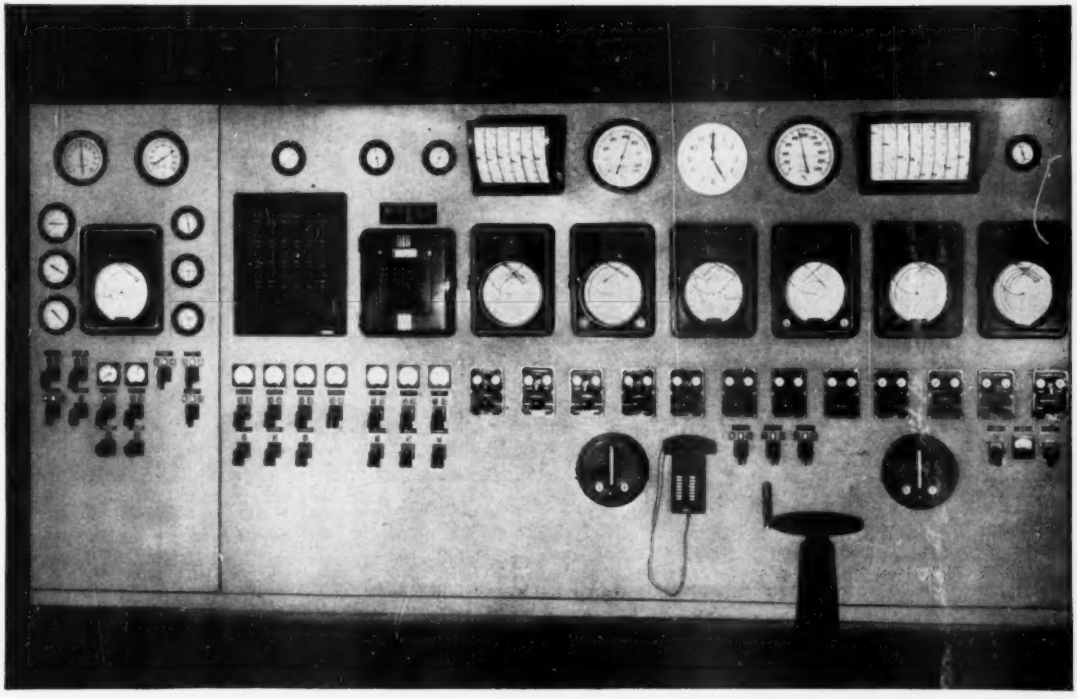
Go a.w.o.l.



This co-ordinated system of Bailey Combustion and Three-element Feed Water Control prevents Btu's from going a.w.o.l. at Potomac Edison Company, Williamsport, Maryland. The maximum steaming capacity of this 860 psi pulverized coal fired boiler is 400,000 lbs. per hour.

Chicago, Milwaukee, St. Louis, New Orleans, St. Paul, Kansas City, Houston, Denver, Los Angeles, Seattle, San Francisco

ASSURE *low cost steam* with the C-E Package Boiler

In more than a score of widely varying industries the C-E Package Boiler is providing low-cost steam – piling up a record of efficiency and economy that is the direct result of service-proved design.

What is this proved design? It is a complete coordination of boiler, furnace and fuel burning equipment – every component in balanced relationship, correctly proportioned for maximum performance at minimum cost.

Among the more important features of the design is the fact that not only the furnace wall tubes but 65 per cent of the surface of the first four rows of boiler tubes in the first pass "sees" the fire. This unusually high percentage of radiant-heat absorbing surface makes the C-E Package Boiler a most rapid and efficient steam producer. At the same time, the completely water-cooled furnace reduces refractory maintenance to a practical minimum.

Nor is the performance of this boiler dependent on one kind of fuel or one type of firing. You may use the firing method best suited to your fuel and load conditions – oil, gas, or stokers (either underfeed or spreader type). Moreover, one method may easily be substituted for another if a change occurs in your local fuel situation.

C-E Package Boiler balanced design is standardized in a range of sizes having capacities from 15,000 to 50,000 lb of steam per hr. This standardization not only assures you top performance in a size that fits your needs, but gives you added savings in lower engineering and installation costs.

For your new steam plant or in the extension or modernization of your present facilities, why not assure yourself of low-cost steam by doing as others have done in industry after industry – buy the C-E Package Boiler.

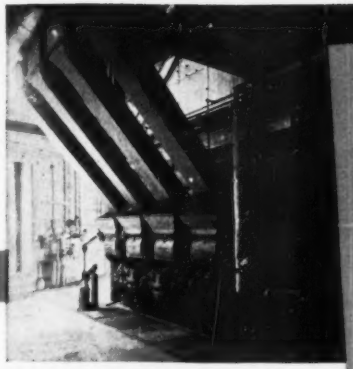
B-263

C-E

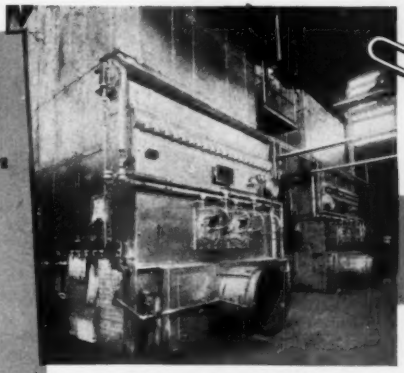
COMBUSTION

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

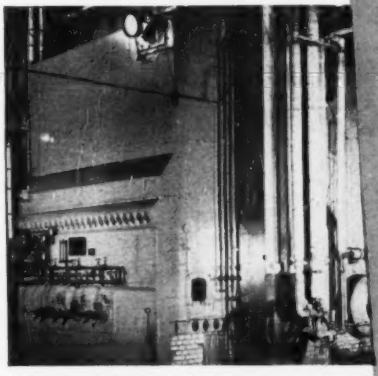
for your plant



C-E Package Boiler fired by C-E Spreader Stoker. Max. continuous capacity — 41,500 lb steam per hr, oper. press. — 150 psi, furnace width — 13 ft 6 in. (in West Virginia)



Two C-E Package Boilers fired with oil. Max. continuous capacity — 26,700 lb steam per hr, oper. press. — 200 psi, furnace width 9 ft 0 in. (in Delaware)



C-E Package Boiler fired with oil. Max. continuous capacity — 31,500 lb steam per hr, oper. press. — 150 psi, furnace width 10 ft 6 in. (in New York)

PARTIAL LIST OF INDUSTRIES THAT HAVE SELECTED THE C-E PACKAGE BOILER

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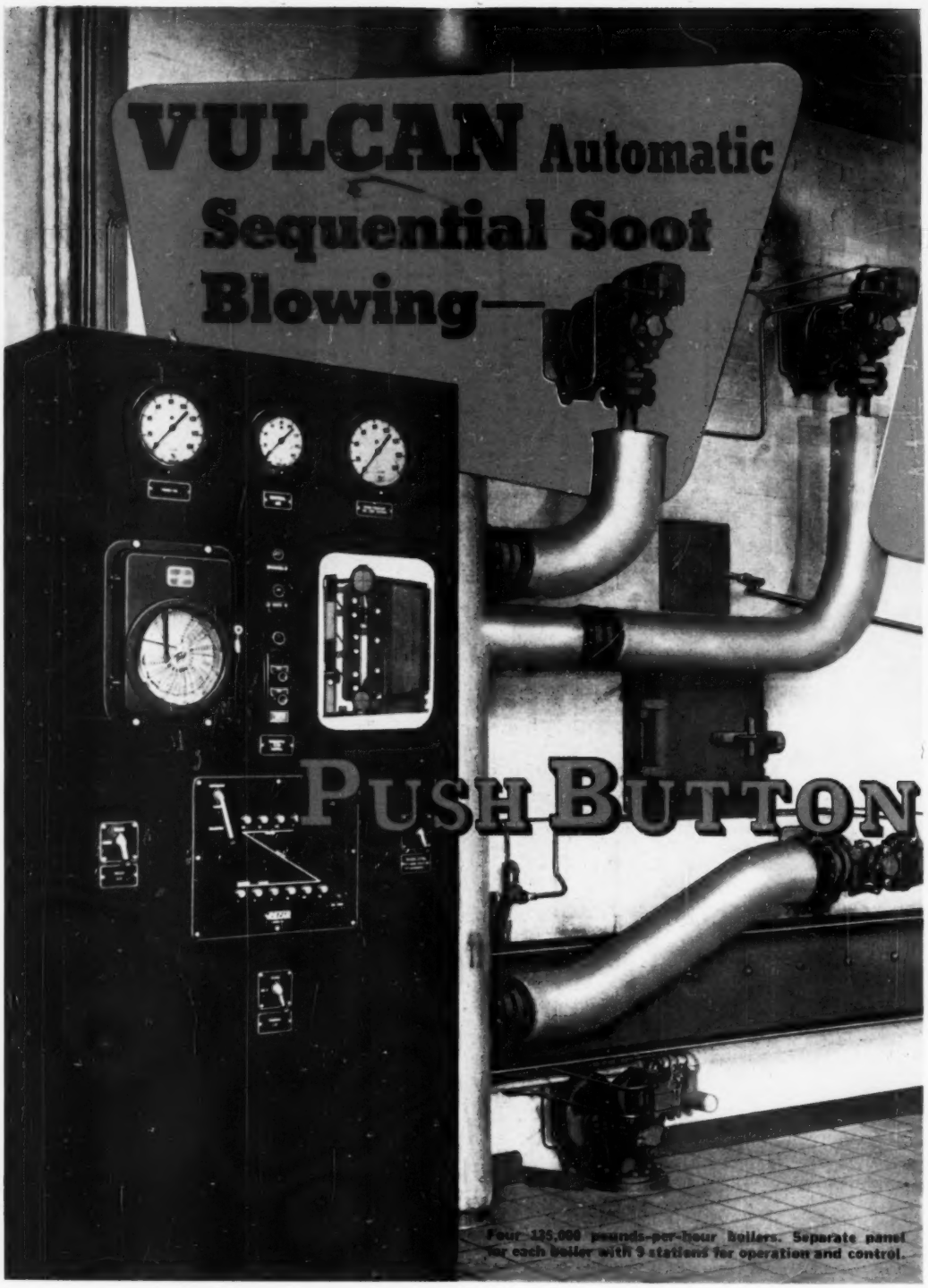
BAKERY
CHEMICAL
COLD STORAGE
DAIRY
GLASS
HOSIERY
HOSPITAL
INSTITUTIONS
LEATHER
LINOLEUM
MACHINERY
METALS
OIL
PACKING
PAINTS
PAPER
RAILROADS
RUBBER
STEEL
SUGAR
TEXTILE
TOBACCO
UTILITY

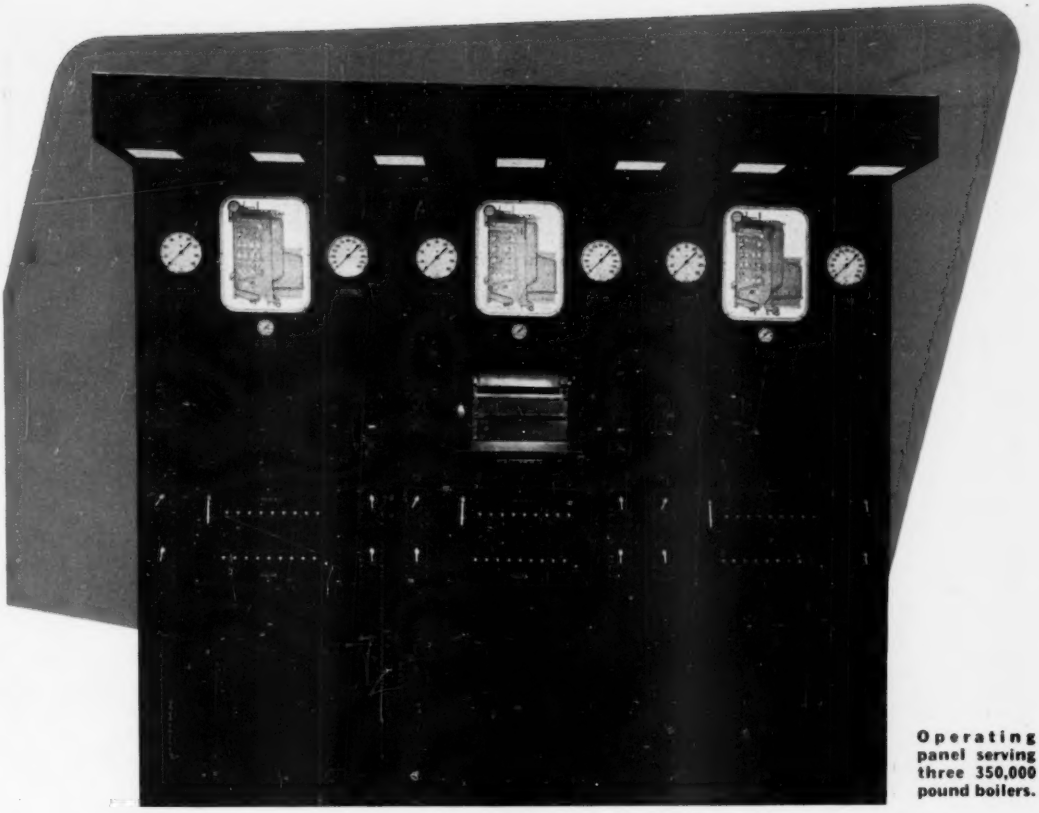
Three C-E Package Boilers fired by Type E Stokers. Max. continuous capacity — 36,000 lb steam per hr, oper. press. — 125 psi, furnace width 12 ft 0 in. (in Ohio)

ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N. Y.



Four 135,000 pounds-per-hour boilers. Separate panel for each boiler with 9 stations for operation and control.



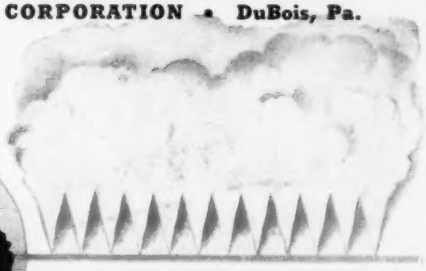
Operating panel serving three 350,000 pound boilers.

...BOILER CLEANING.

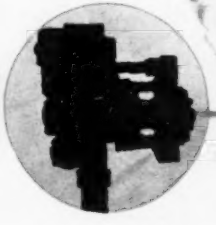
The operator of the above panel has three 350,000 pounds-per-hour boilers, each with 18 soot blowing stations, at his fingertips. He can push one button and operate an entire boiler cleaning system and shut it down. He can blow by groups, skip one unit or several units as he wishes. Any combination is possible

Vulcan Automatic Sequential Soot Blowing Systems, steam or air blowing, are most popular because of unusual design and flexibility. Look to Vulcan, the oldest name in Soot Blowing for the most modern of central control systems. Write for recommendations.

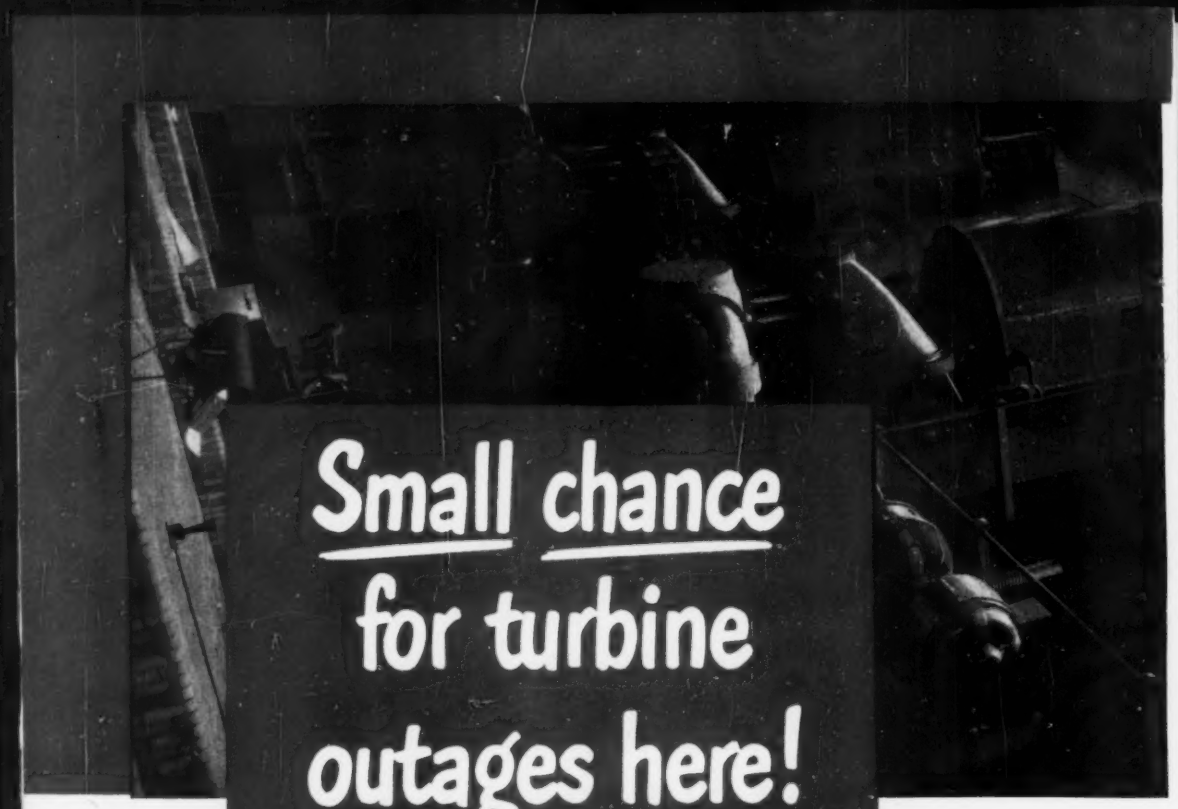
VULCAN SOOT BLOWER CORPORATION • DuBois, Pa.



VULCAN
STEAM OR AIR



SOOT BLOWERS



Small chance for turbine outages here!

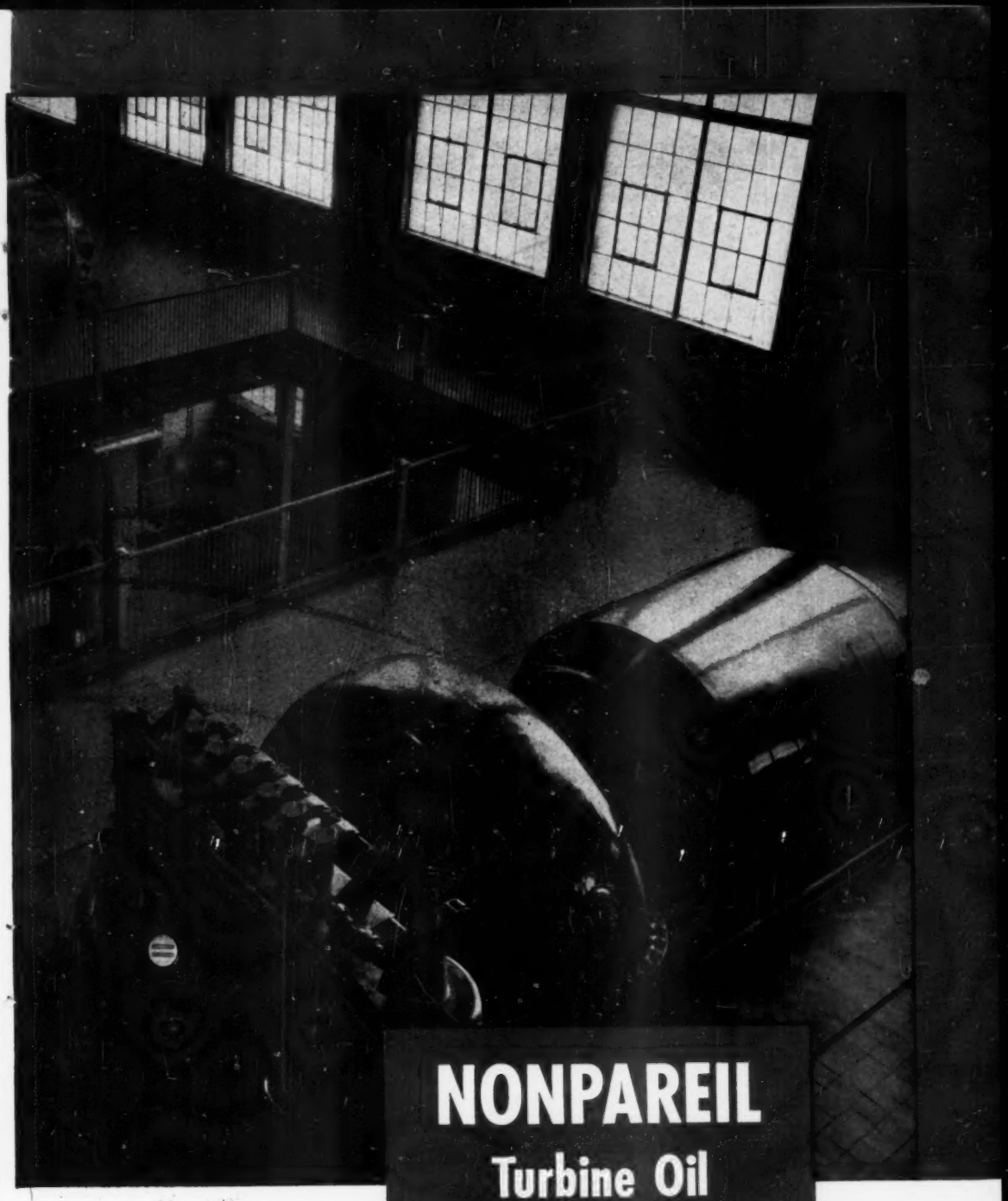
The midwest utility plant, shown in the above photograph, runs little risk of enforced turbine outages because of oil trouble. The 14-year performance record of Nonpareil Turbine Oil at this plant provides the basis for this assurance of safety.

In 1934, Nonpareil was put into one 15,000 KW turbine. A 7,500 KW unit and a second 15,000 KW unit were started on Nonpareil in 1935 and 1941, respectively. The original fills of oil have remained in these turbines for the 7 to 14 years of operation. There has been no deterioration of the lubricant. The oil has not been removed for treating or resting, yet neutralization numbers have stayed below 0.09. There has been no outage time, scheduled or unscheduled, for oil-system maintenance.

Nonpareil assures trouble-free operation for the life of *every* turbine it lubricates. This unusual lubricant is the only product in its field that carries a written guarantee that it will last as long as your turbine without increasing in acidity above 0.15 mg. KOH/gm.

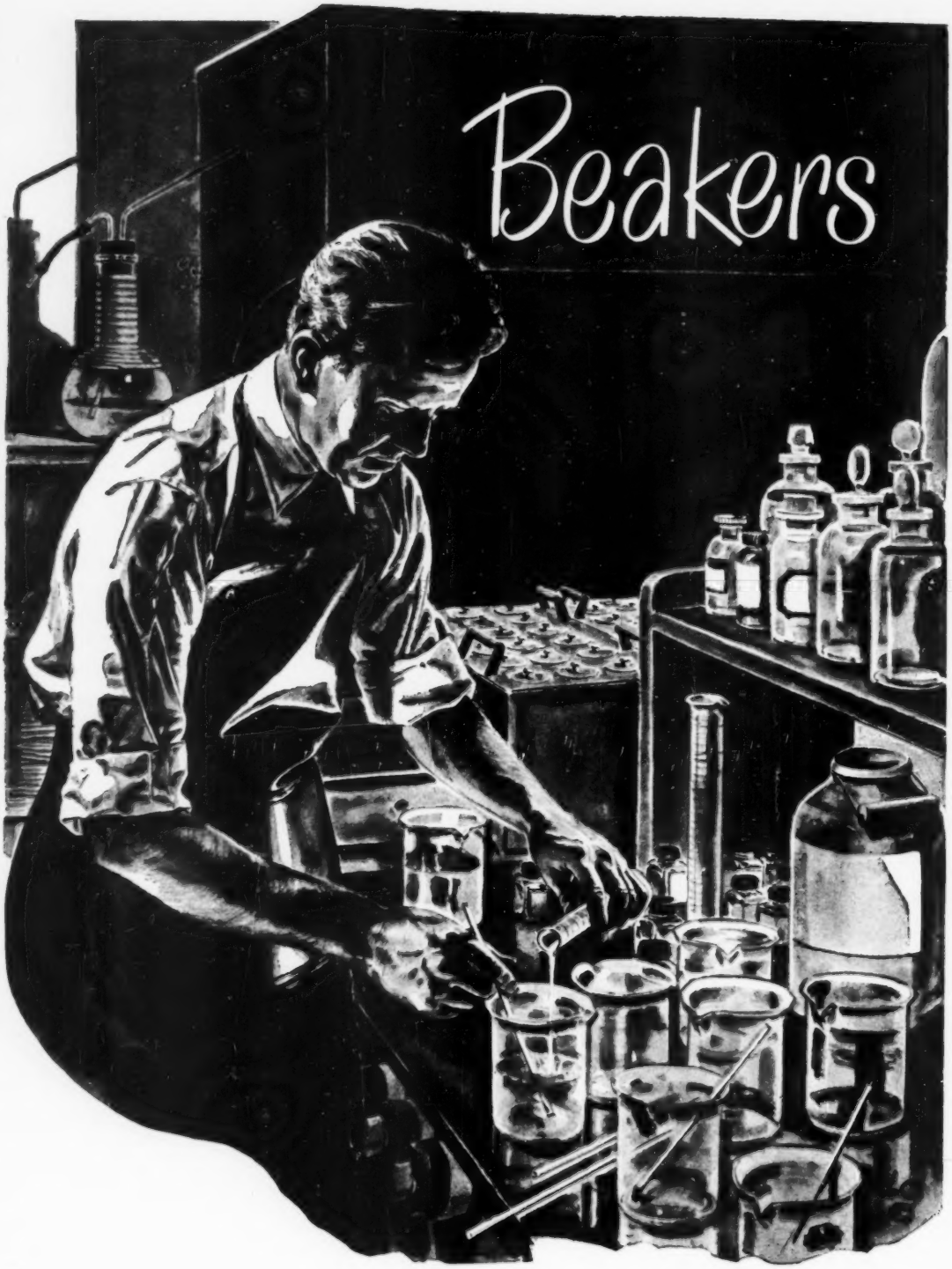
A Standard Oil Lubrication Engineer will be glad to show you this written guarantee and discuss the advantages its holds for you. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA)



STANDARD OIL COMPANY (INDIANA)

STANDARD


Beakers

and Boiler tubes

Everyone concerned with boiler operation today realizes that steam generation inevitably involves a complex chemical problem. Water itself and the impurities which it may contain; the chemicals required for treatment; the materials of which the boiler and other components of the steam generating system are made; the compounds formed by interaction of these varied substances—all these and many other factors enter into the problem.

It is a problem which must be attacked by many methods, and one of the most important of these is *chemical analysis of deposits in boilers.* Such analysis shows, for example, the extent to which constituents of a tube deposit are sludge components, boiler scales, or corrosion products. It measures the extent to which the ordinary calcium compounds are admixed with the less common ones of zinc or the really unusual ones of barium and strontium. It will reveal the amount of magnesium present and give some information about the form in which it has been precipitated.

These and other facts brought out by chemical analysis may be of great importance in assaying current conditions and evaluating immediate problems and potential difficulties. From the results, corrective procedures, if necessary, can be set up.

In Hall Laboratories, chemical analysis of deposits is primarily quantitative analysis, and is supplemented by microscopic, x-ray, spectrographic and other methods. Thus Hall engineers get the fullest possible information on all factors involved in your problem—and this thoroughness is one reason why Hall service is used continuously by so many plants, of all types and sizes, in all parts of the country.

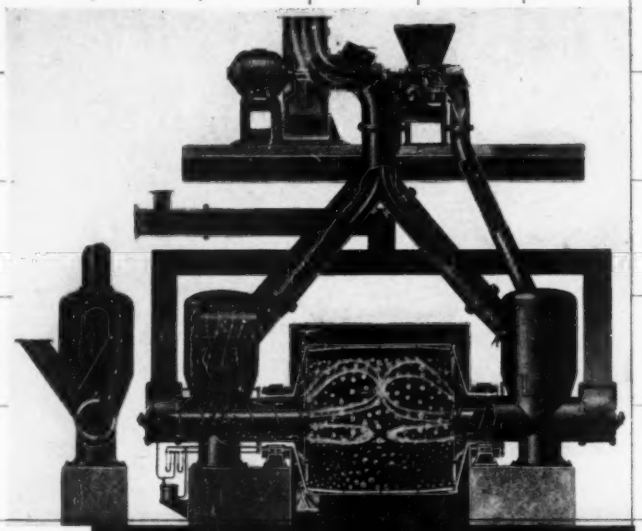
Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pennsylvania.

HALL LABORATORIES, INC.

(A Subsidiary of Hagan Corporation)

CONSULTANTS ON
INDUSTRIAL WATER TREATMENT
HALL SYSTEM OF BOILER WATER CONDITIONING
INDUSTRIAL WASTE RECOVERY AND DISPOSAL

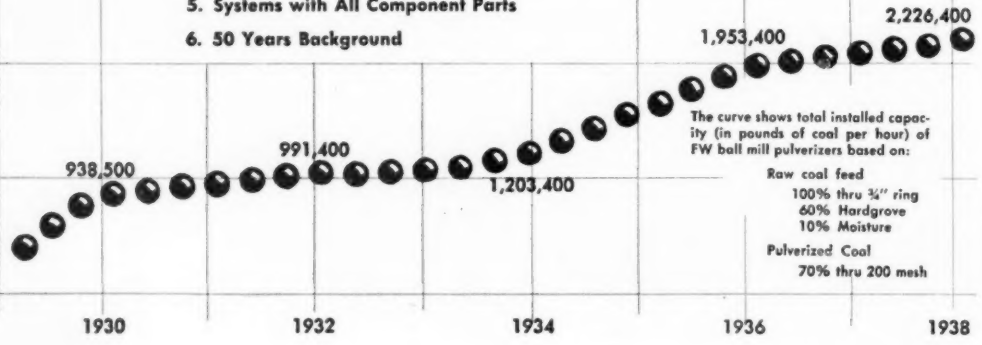
The FW Ball Mill keeps pace



The FW ball mill pulverizer provides one of the most effective methods of pulverizing hard or abrasive fuels. Its rapidly increasing use testifies to its efficiency, availability, and economy of operation.

Outstanding Features

1. Large Reserve Capacity
2. High Availability—Low Maintenance
3. Constant Fineness
4. Successful Installations for Pulverizing
   a. Anthracite Coal b. Bituminous Coal
   c. Coke Breeze d. Lignite e. Petroleum Coke
5. Systems with All Component Parts
6. 50 Years Background



The curve shows total installed capacity (in pounds of coal per hour) of FW ball mill pulverizers based on:

Raw coal feed
100% thru ¾" ring
60% Hardgrove
10% Moisture

Pulverized Coal
70% thru 200 mesh

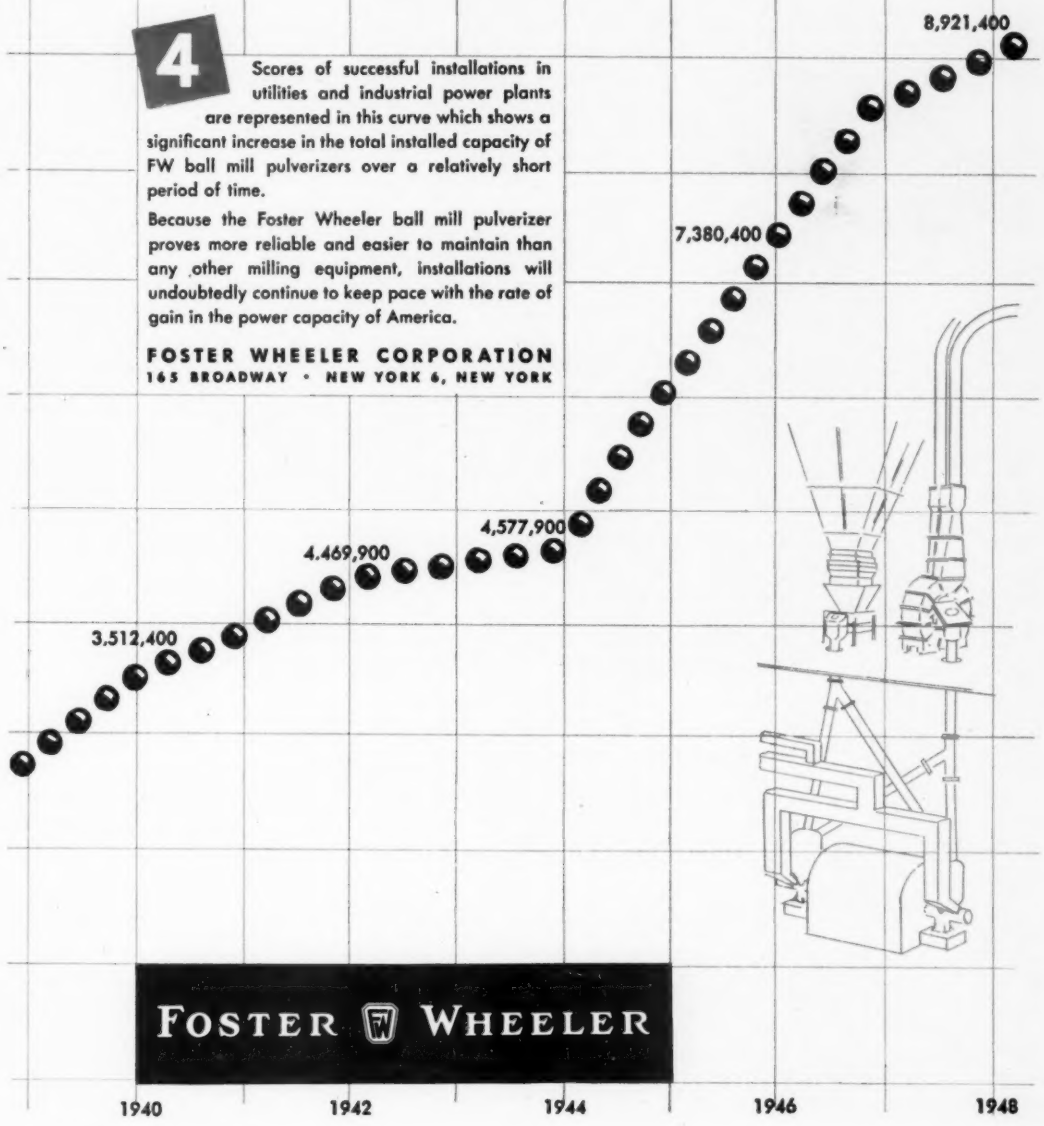
with Power Needs!

4

Scores of successful installations in utilities and industrial power plants are represented in this curve which shows a significant increase in the total installed capacity of FW ball mill pulverizers over a relatively short period of time.

Because the Foster Wheeler ball mill pulverizer proves more reliable and easier to maintain than any other milling equipment, installations will undoubtedly continue to keep pace with the rate of gain in the power capacity of America.

FOSTER WHEELER CORPORATION
165 BROADWAY • NEW YORK 6, NEW YORK



FOSTER WHEELER

LUNKENHEIMER

...with 3 way

Interchangeability of parts provided by the "RENEWO" Valve Threesome lowers stock room investment because fewer types of valves and parts are needed. Ordering and handling are simplified; repairs are facilitated. You save time, labor, money. There's the standard "Renewo" with long-wearing nickel alloy seat and disc... all parts renewable quickly and easily. And, if desired, you can replace seat and disc, while the valve remains in the line... with either the nickel alloy 330 Brinell seat and disc... or the stainless steel 500 Brinell seat and disc.

The availability of these valves in 200 lb. S.P. as well as in 300 lb. S.P. is another important advantage of this series.

The "RENEWO" Threesome is fully described in Circular No. 577, which also explains the economy feature of converting one type to another by simply changing seat and disc. A copy is yours for the asking... from your Lunkenheimer Distributor or from us direct.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO, U. S. A.

NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 34

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

"P" TYPE

Nickel Alloy Seat and Disc

Fig. 73-P—200 lb. S.P. Fig. 16-P—300 lb. S.P.

"P" (Plug Type) "RENEWO": for throttling, drain, drip water column blow-down and similar service. The "N55" Nickel Alloy 330 Brinell seating material, developed and patented by Lunkenheimer, has exceptional wearing qualities and high corrosion resistance.

PRECISION MADE PARTS

In manufacturing plug type seats and discs, a special precision machine finishes both seat and disc simultaneously. Then each disc is lapped into its own seat to a fit as perfect as can be made. This insures uniform bearing throughout the seating area and a leak-tight seat. The greater area of the wide seating surface retards wire-drawing and promotes longer life.

"RENEWO" VALVE THREESOME

interchangeability!

SIMPLIFIES VALVE SELECTION

REDUCES MAINTENANCE EXPENSE

REGULAR TYPE

Nickel Alloy Seat and Disc

Fig. 73—200 lb. S.P. **Fig. 16—300 lb. S.P.**

Regular "RENEWO": one of the most popular and widely used valves ever designed for general service. As the name clearly implies, all parts are renewable.

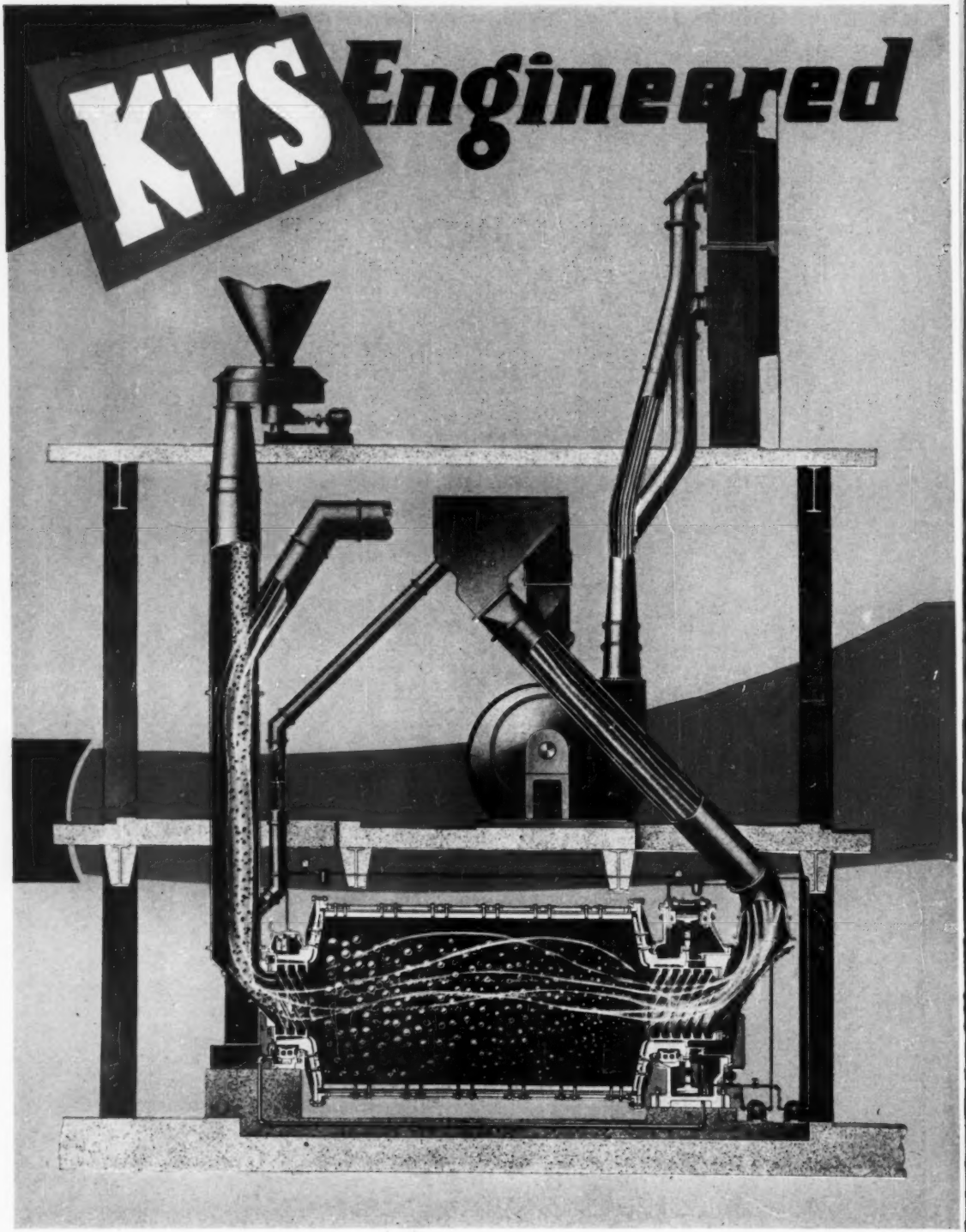
"PS" TYPE

Stainless Steel 500 Brinell Seat and Disc

Fig. 73-PS—200 lb. S.P. **Fig. 16-PS—300 lb. S.P.**

"PS" (Plug Type) "RENEWO": for maximum resistance to the effects of close throttling and other severe service, particularly where abrasive conditions are encountered. Equipped with Stainless Steel 500 Brinell seat and disc.

Service IS A WORD LUNKENHEIMER DISTRIBUTORS UNDERSTAND—"On-the-spot" service is a specialty of the Lunkenheimer Distributor, who supplies parts, valves and helpful service when you need it most! There are hundreds of these distributors, covering every industrial area in the United States. One of them is near your plant . . ready to serve you NOW . . . or at any time an emergency arises.


KVS Engineered

Coal FIRING...

provides "TALCUM POWDER" fineness

and

COMPLETE COMBUSTION

High efficiency in KVS Pulverized Coal Firing is the direct result of superfine pulverization in the KVS Air Swept Tube Mill.

Air sweeping, a Kennedy patented exclusive feature provides for coal and air entering at feed end and leaving at discharge end. This system is simple, effective and trouble free. Greater capacity is provided within a given floor area.

This slow speed ball mill provides fuel *instantly combustible*. Maintenance cost is low.

KVS Air Swept Tube Mills have operated continuously twenty-four hours a day for years without interruption for service. Balls for grinding can be added without stopping the mill. Classification of balls is *never* necessary.

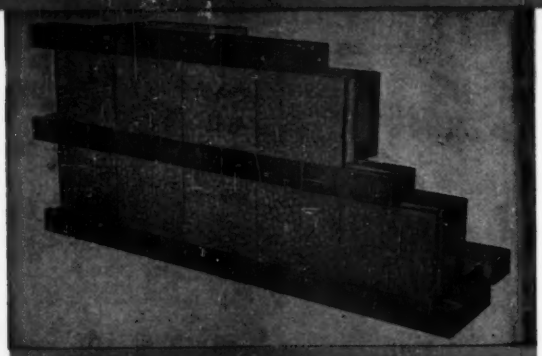
KVS ENGINEERING SERVICE

KVS offers a complete service in design, building and erecting complete steam generating plants under one responsibility, KVS engineers are available for consultation on your requirements.

Ask for a copy of 97-page Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generating plants.

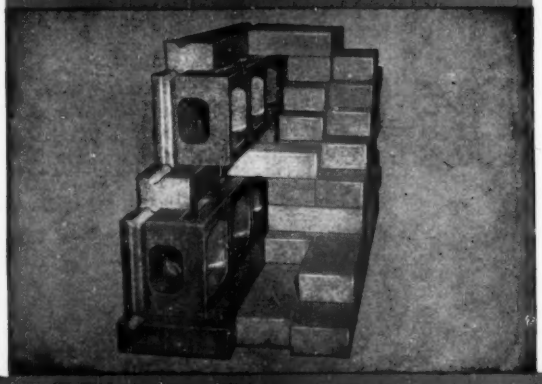
Kennedy Products — Kennedy-Van Saun MANUFACTURING AND ENGINEERING CORPORATION — 2 PARK AVENUE • NEW YORK 16, N. Y. — ARMY E NAVY

CRYSTOLON *Air Cooled* BLOCKS



Crystolon Blocks and Special 9" Brick Fire Face View

Rear View Showing Hollow Block Design



End View Showing Air Passage

CRYSTOLON

CRYSTOLON is the Norton Company trade-mark for silicon carbide. Silicon carbide, produced in the electric furnace quite extensively as an abrasive is also an exceptionally refractory substance. A maximum of silicon carbide and a minimum of refractory bond are used to make CRYSTOLON shapes which find successful use in boiler furnaces.

for *Air Cooled* WALLS in BOILER FURNACES

CRYSTOLON Hollow Blocks are specially designed for the scientific construction of air cooled walls in boiler furnaces. In addition to their unique design, these blocks (like CRYSTOLON Bricks for solid walls) possess the four basic outstanding qualities of silicon carbide. The result is lowered boiler lining cost:

(1) **Unusually high refractoriness.** Bonded CRYSTOLON Shapes are successfully used at temperatures up to 2900°F. (1595°C.).

(2) **Resistance to slag action.** The action of molten slag is tough on any refractory—but CRYSTOLON blocks and bricks are made so dense that slag will not take hold by penetration.

(3) **Resistance to clinker adhesion.** CRYSTOLON blocks and bricks are designed to reduce the adhesion of clinkers to a minimum. If clinkers do adhere to a limited extent, they are easily removed without any damage to the surface of the block or brick.

(4) **Resistance to abrasion.** Silicon carbide is an abrasive material of extreme hardness and, therefore, CRYSTOLON blocks and bricks show remarkable resistance to abrasion—including that caused by the moving fire bed of a stoker-fired furnace.

CRYSTOLON air cooled blocks are designed as a full block having a 9" base or as a half block with a 4½" base. They have a definite relation to the standard 9" CRYSTOLON straight brick and can be used in conjunction with it. In addition there are modifications of the 9" brick shapes, provided with standard tongues and grooves, for use in conjunction with the blocks as both headers and stretchers. The blocks are made with either a blank face or a perforated face having two or four holes.

NORTON CO. WORCESTER 6, MASS.

ONE OF A SERIES . . . *Allis-Chalmers Water Conditioning*

Well known Dairies rely on Allis-Chalmers Sodium Zeolite Softeners

. . . TYPICAL OF A-C AID TO ALL INDUSTRIES FACED WITH WATER TREATING PROBLEMS

SUCCESSFUL dairies ordinarily can't spend time and effort to investigate their water conditioning problems. Instead, they work with a competent water treating organization to get help.

Allis-Chalmers in the water conditioning field provides not only a first hand study of water treating needs, but works right along with you in selecting the right process and correct equipment for your requirements—whether boiler feed water, cooling water, or process work.

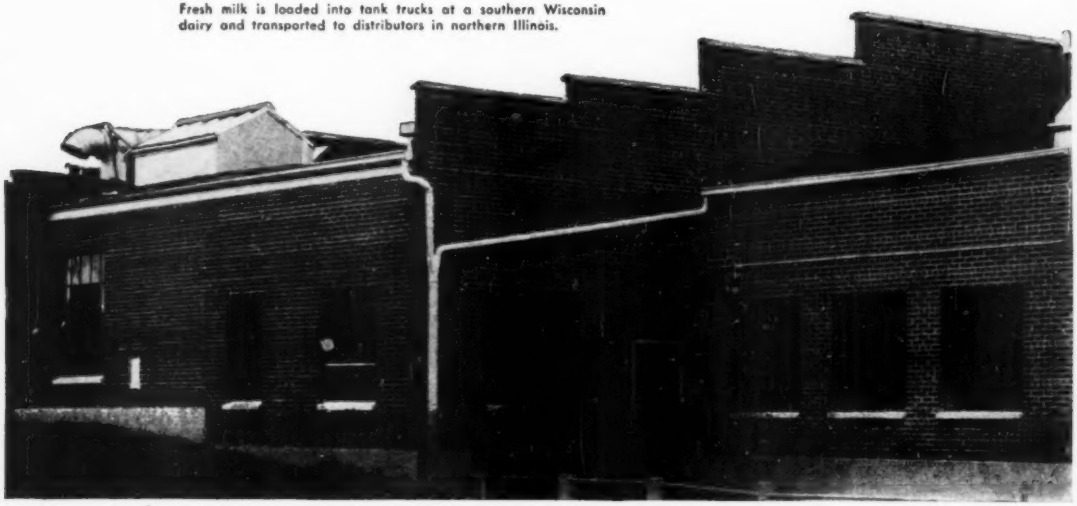
Allis-Chalmers Provides Service, Chemicals, Equipment.

SERVICE starts with a complete study of water supplies and impurities, surveys of present methods and plant operating conditions. Following this: recommendations, selection of chemicals, periodic reports, and service calls.

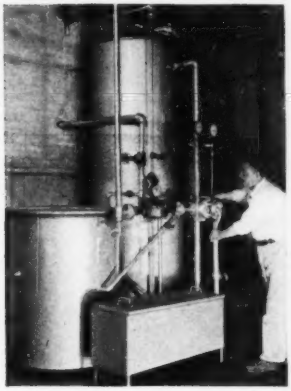
CHEMICALS comprise a complete new line of formulations for scale and corrosion control in all types of cooling towers and heat exchangers. Also the Reliable AKON and SILIMITE chemicals—AKON chemical for prevention of boiler scale and corrosion and SILIMITE chemical for silica reduction.

EQUIPMENT includes hot and cold process softeners, sodium and hydrogen zeolite softeners, degasifiers, deionizers, chemical proportioners, and oil removal and water filters.

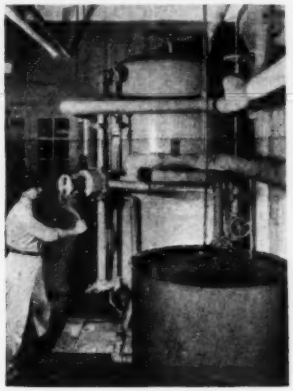
Fresh milk is loaded into tank trucks at a southern Wisconsin dairy and transported to distributors in northern Illinois.



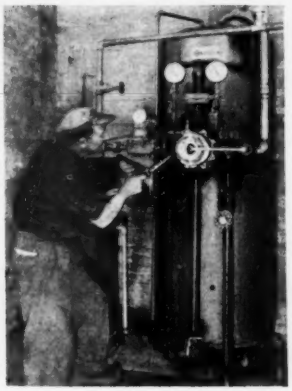
(SERVICE • CHEMICALS • EQUIPMENT) *at Work in Industry*



A 7,500 gal. zeolite softener installed at a Wisconsin dairy last year typifies many smaller installations in all industries. Softened water from this unit is heated to 190 F for the can washer. Softener also supplies feedwater to boiler for steam heating the building. Additional steam is used for evaporating and pasteurizing, as well as drying 2,800 lbs. of milk per hour.



This 9,000 gal. zeolite softener was installed at Wisconsin's world famous Pabst Farms dairy over three years ago. It treats extremely hard well water which boilers turn into steam at 150 psi for evaporating, pasteurizing and drying operations. Steam is also used to heat the dairy buildings where milk from 1,500 head of Holsteins is processed daily.

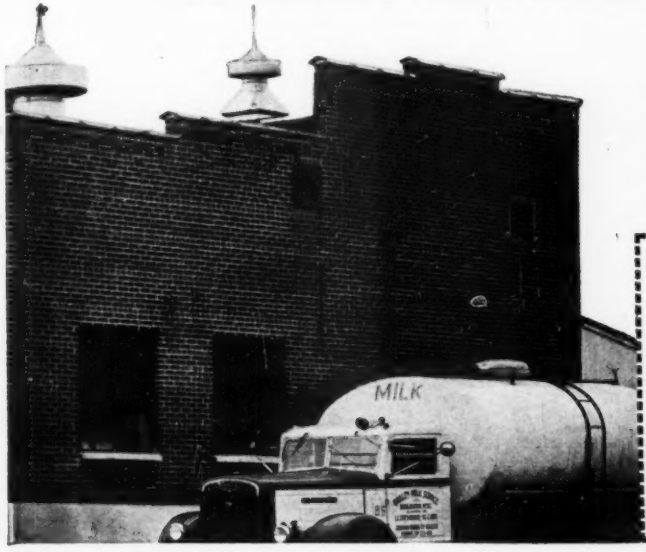


A 5,000 gal. zeolite unit recently installed at Dairyland Co-op in eastern Wisconsin keeps a 100 lb. boiler supplied with soft water to provide exceptionally clean steam for numerous dairy operations. In addition to heating the plant, pasteurizing, cooling, and can washing, steam is also used in the preparation and processing of various types of cheese.

AKON and *SILIMITE* are Allis-Chalmers Trade-Marks

ALLIS-CHALMERS

Water Conditioning Service . . . Chemicals . . . Equipment



JUST OUT—the new Allis-Chalmers Sodium Zeolite Bulletin!

Send for this simple yet thorough discussion of water hardness and the sodium zeolite softener. Fully describes applications, operation, controls, layout and piping!

A 2558

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

Please send me Bulletin 7107

Name.....

Company.....

Title.....

City..... State.....

"We Had Approximately 300 Motors 'Single Phase' At One Time—But Didn't Lose a Single One" . . . .

"About three months ago a primary fuse on the pole blew and threw our entire plant on single phase. At the time our plant was running full force, which meant there were approximately 300 motors running.

"Most of the motors were protected with relays or thermals, backed up by Fusetron fuses. The rest were protected by Fusetron fuses alone.

"As quickly as we realized the single phase condition existed, the main switch was pulled.

"By that time many Fusetron fuses had blown — but we didn't lose a single motor.

"Fusetron fuses more than paid for themselves that day even though we had but a short time previously gone to the expense of making a complete installation throughout the entire plant."

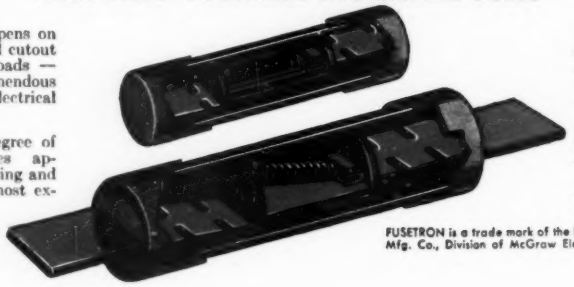
. . . Chief Electrician,
Twin Coach Co., Kent, Ohio

. . . "Thanks to . . . .

Facts About FUSETRON Dual-Element FUSES

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.



Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

Fusetron DUAL-ELEMENT Fuses

with their

10 Point Protection

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

Get All the Facts - Send the Coupon Now!

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

FUSETRON Dual-Element Fuses Give ALL-PURPOSE PROTECTION

One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about Fusetron Dual-Element Fuses.

*Name*_____

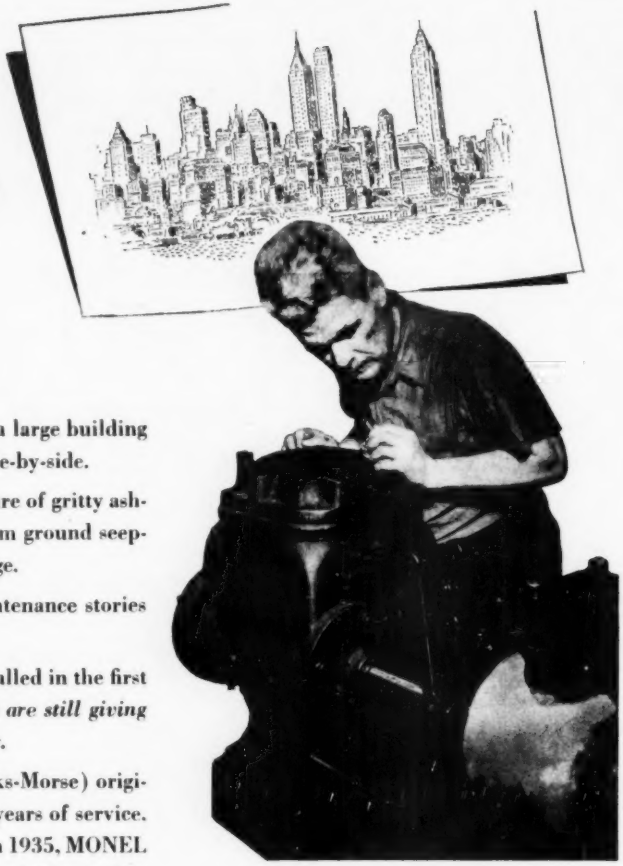
*Title*_____

*Company*_____

*Address*_____

*City*_____ *State*_____ 149

30-YEAR OLD MONEL PUMP RODS OUTLAST OTHERS 9 TO 1



Fairbanks-Morse sump pump. The 30-year old MONEL pump rods have never been replaced or reground, show very little wear, and seldom need repacking.

In the basement power plant of a large building in New York City, two pumps work side-by-side.

Both pumps handle a sump mixture of gritty ash-quenching waters, polluted waters from ground seepage, corrosive waters from coal drainage.

Identical service...but their maintenance stories are far from identical!

In 1918, MONEL* rods were installed in the first pump, a Fairbanks-Morse. These *rods are still giving perfect service today, thirty years later.*

The second pump (not a Fairbanks-Morse) originally had bronze rods. In the first ten years of service, these rods were replaced *three times.* In 1935, MONEL rods were installed. They have been giving perfect service ever since...*for thirteen years.*

The chief engineer says of the MONEL rods: "In my opinion, they will last as long as the pumps."

This is a story worth remembering next time you need pump rods, new or replacement. For when you specify MONEL, you get a "task metal"...one that is rustproof, corrosion-resistant, stronger than structural steel, hard, tough, yet readily machinable.

If your problem involves corrosion or excessive wear of working parts, why not write to Bob Johnson of INCO? He may be able to help you find a solution.

*Reg. U.S. Pat. Off.

MONEL

...FOR MINIMUM MAINTENANCE

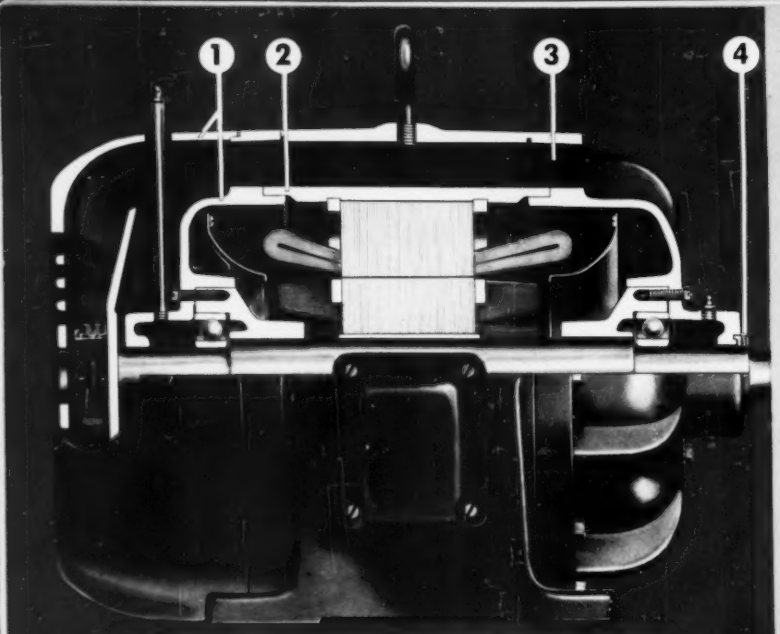
EMBLEM OF SERVICE

INCO

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York 5, N. Y.

YOU CAN PUT A
TRI CLAD
REG. U.S. PAT. OFF.
MOTOR ANYWHERE
GENERAL ELECTRIC
HERE'S WHY



The standard totally enclosed Tri-Clad features a *cast-iron* double-wall structure (1) that keeps outside air from electrical operating parts . . . machined-fit end shields (2) . . . large air passages (3), easy to clean . . . rotating labyrinth seals (4) that keep foreign matter from working in around the shaft. Note, too, the new corrosion-resistant G-E Textolite cooling fan is now standard on all 1- to 15 hp TEFC Tri-Clads.

You can put a *TRI CLAD* motor anywhere

YES SIR! The standard *Tri-Clad* open motor is a *cast-iron, dripproof* motor you can put anywhere that *any* open motor can be used—and in a lot of places where other open motors couldn't take it.

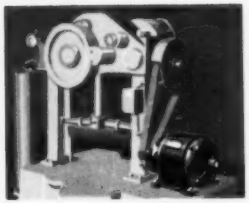
What's more, for the really dirty jobs—where air is laden with dust, or corrosive fumes—where metal chips and cutting fluids abound—the Tri-Clad totally enclosed motor gives you more protection, *inside and out,* than any other make of motor you can buy.

1,720,000 Tri-Clad motors, operating in every conceivable kind of plant, prove the far-reaching advantages of cast-iron construction . . . superior resistance to corrosion . . . rigidity that makes for permanent shaft alignment . . . inherent damping action that minimizes noise and damaging vibration. These motors prove, too, that Tri-Clad double-end ventilation simply has no equal for prolonging an open motor's useful life. Providing high-volume, relatively low-velocity cooling, this ventilating system keeps Tri-Clad motors *uniformly* "air-conditioned".

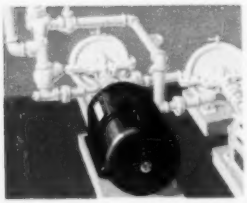
WANT MOTORS THAT CAN REALLY TAKE ABUSE? Tri-Clad motors in nearly all types and ratings are available for **IMMEDIATE SHIPMENT.** Contact your nearest G-E Office or write *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

There's a Tri-Clad motor for every industrial need!



G-E open (dripproof) induction motors for constant-load, constant-speed applications. From 1 to 2000 hp.



G-E totally enclosed motors for outdoor operation, in abrasive dusts, or corrosive fumes. From 1 to 1000 hp.

G-E gear-motors for low-speed operation. A normal-speed motor with built-in reduction gear. From ⅛ to 75 hp.

G-E synchronous motors for maintaining exact speeds or for correcting power factor. From 20 to 1000 hp.

YOU CAN'T BEAT
TRI CLAD
EXTRA PROTECTION

CLEAN, SIMPLE, EFFICIENT...

Location:

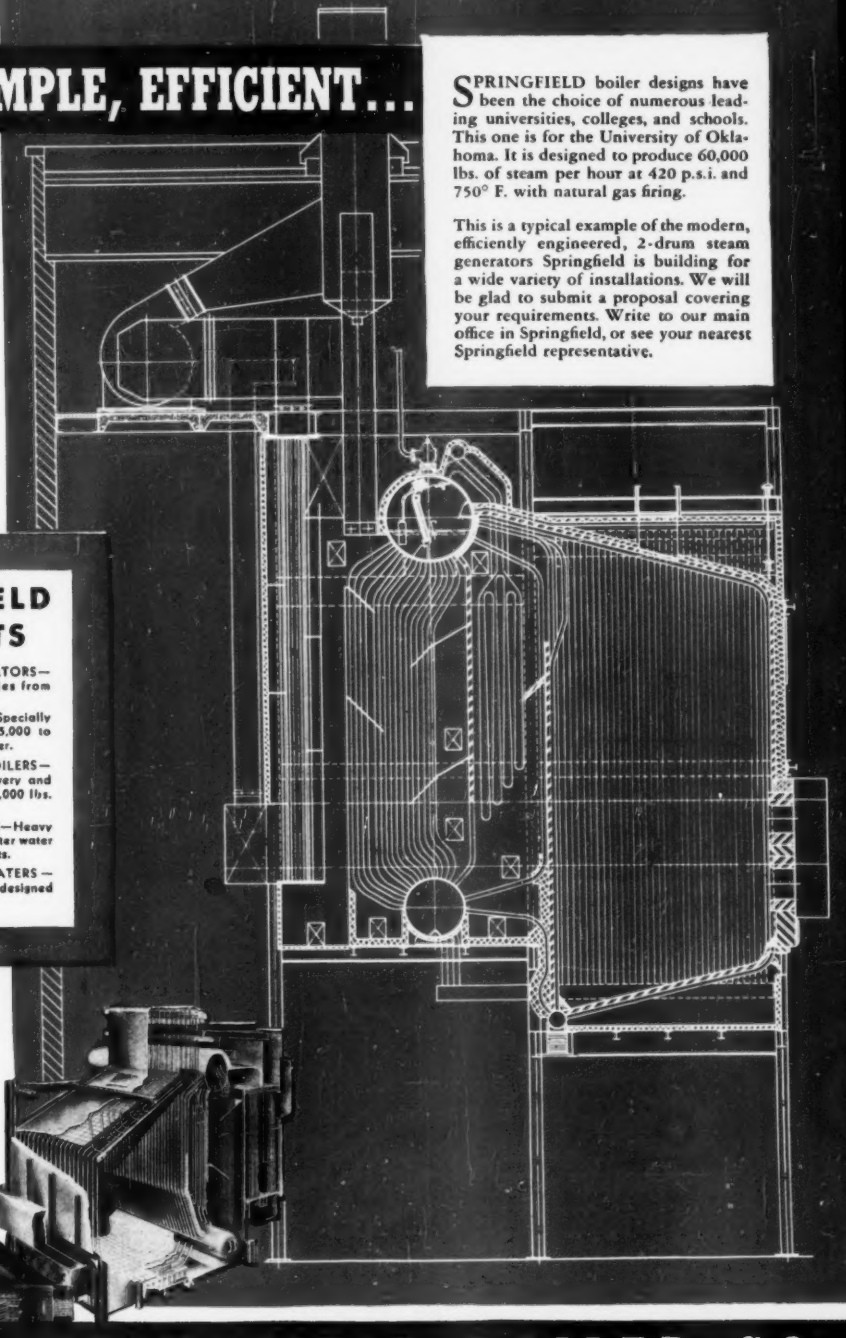
UNIVERSITY OF OKLAHOMA
Norman, Okla.

Consulting Engineers:

COSTON & FRANKFURT
Oklahoma City, Okla.

SPRINGFIELD boiler designs have been the choice of numerous leading universities, colleges, and schools. This one is for the University of Oklahoma. It is designed to produce 60,000 lbs. of steam per hour at 420 p.s.i. and 750° F. with natural gas firing.

This is a typical example of the modern, efficiently engineered, 2-drum steam generators Springfield is building for a wide variety of installations. We will be glad to submit a proposal covering your requirements. Write to our main office in Springfield, or see your nearest Springfield representative.



SPRINGFIELD PRODUCTS

BENT TUBE STEAM GENERATORS—Modern designs for capacities from 10,000 lbs. up.

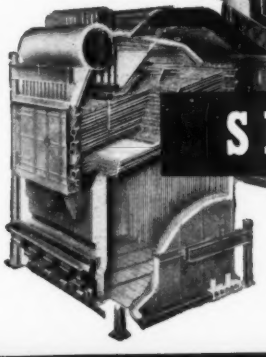
STRAIGHT TUBE BOILERS—Specially designed for capacities from 5,000 to 450,000 lbs. per hour and higher.

STANDARDIZED TYPE M BOILERS—Standardized for quicker delivery and lower cost. Sizes 6,000 to 17,000 lbs. per hour.

WATER COOLED FURNACES—Heavy duty water walls. Exclusive center water wall construction for larger units.

SUPERHEATERS — AIR HEATERS — ECONOMIZERS—Individually designed to meet requirements.

CHECK WITH YOUR CONSULTING ENGINEER ON YOUR MODERNIZATION AND NEW PLANT PROJECTS.



SPRINGFIELD BOILER CO.

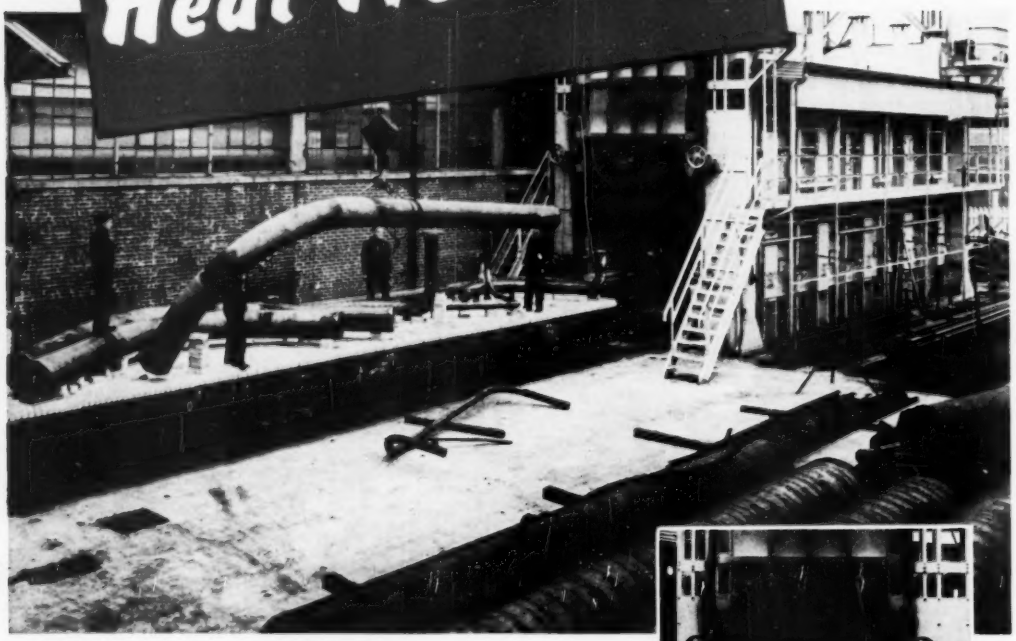
1953 E. Capitol Ave. Springfield, Illinois

WORLDWIDE SALES AND SERVICE

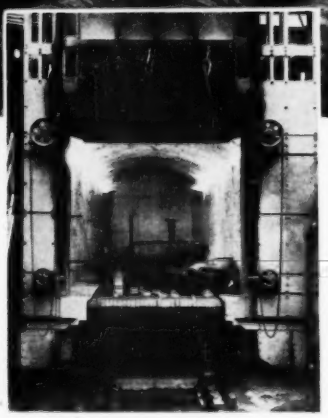
NEW YORK • PHILADELPHIA • WASHINGTON, D.C. • DETROIT • SALEM, MASS. • HOUSTON
CHICAGO • SAN FRANCISCO • ST. LOUIS • CINCINNATI • MEXICO, D.F. • BUENOS AIRES

Export: READING, PA.

Heat Treatment



Loading of pipe assembly on car bottom for heat treating operation. Exterior of furnace is shown on right.



Interior of Heat Treating Furnace—12' wide, 10' high and 40' long. Oil-fired, its temperature range is 1100° to 2000° F.

this SHAW furnace

is designed for stress relieving, annealing or normalizing—of fabricated piping assemblies and pressure vessels in whole or part. Whether your piping contract is large or small—whether you require heat treating or a complete fabrication and installation job—call on Shaw. You'll find it pays.

Benjamin F. SHAW Company

2nd and Lombard Sts. Wilmington 99, Delaware

Benjamin F. Shaw Company is qualified to pre-fabricate and erect piping throughout the world.

President

Known Since 1893 for High-Quality Piping Pre-Fabrication and Installation

You save with the Worthington YC Compressor—right from the start.

It arrives completely assembled. Installation cost is low, because there's no alignment problem. No erecting engineer needed. Just make the air and power connections and it's ready for work.

You save on space, too. The YC needs only one-half the building space and one-quarter the foundation space of same-capacity horizontals.

There's more operating economy for you in the balanced Y-frame construction for higher rpm and the famous Worthington Feather* Valves—most efficient ever made.

And for years to come you'll benefit from maintenance savings. Valves are unusually accessible; openings are large for quick inspection; spare parts are smaller, less expensive. And finally, you'll always pay less for power, due to the YC's instantly responsive 3- and 5-step *variable capacity control.*

WRITE FOR DETAILS

that show how Worthington YC Compressors can reduce your air costs. Bulletin L-667-B1A has the facts that prove *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, New York.*

WORTHINGTON

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

*Reg. U. S. Pat. Off.

K8-4

Y-Types | Vertical | Horizontal | Portable | Radial | Gas-Engine Compressors

TYPICAL REPUBLIC AUTOMATIC

SPREADER STOKERS

ALLIS-CHALMERS MFG. CO.
Springfield, Ill.
2 boilers: 68,000 lb./hr. each: 160 lb.

ALLIED CHEMICAL & DYE CO.
Chicago, Illinois
1 boiler: 45,000 lb./hr.: 125 lb.

BUICK AVIATION PLANT
Melrose Park, Illinois
1 boiler: 90,000 lb./hr.: 175 lb.

CHICAGO & NORTHWESTERN R. R. CO.
Green Bay, Wisconsin
2 boilers: 25,000 lb./hr. each: 125 lb.

DAIN MFG. CO.
Ottumwa, Iowa
2 boilers: 518 hp. each: 175 lb.

HUBINGER CO.
Keokuk, Iowa
1 boiler: 150,000 lb./hr.: 500 hp.

CLINTON ENGINEERING WORKS
Oliver Springs, Tenn.
3 boilers: 40,000 lb./hr. each: 300 lb.

CLINTON ENGINEERING WORKS
Clinton, Tenn.
3 boilers: 50,000 lb./hr.: 175 lb.

NORTHWESTERN YEAST CO.
Chicago, Illinois
1 boiler: 338 hp.: 140 lb.
2 boilers: 253 hp.: 140 lb.

MARSHALL CANNING CO.
Marshalltown, Iowa
1 boiler: 40,000 lb./hr.: 160 lb.

KRAFT FOODS
Hutchinson, Minn.
2 boilers: 316 hp. each: 150 lb.

KRAFT FOODS
Albany, Minn.
2 boilers: 338 hp. each: 160 lb.

PYRAMID COAL CORP.
Pinchneyville, Illinois
3 boilers: 40,000 lb./hr. each: 210 lb.

WALWORTH CO.
Kewanee, Illinois
1 boiler: 60,000 lb./hr.: 200 lb.

SCHENLEY DISTIL
Lawrenceb
2 boi

ings corp.
Harbor, Indiana
oiler: 30,000 lb./hr.: 150 lb.

U. S. NAVAL TRAINING STATION
Farragut, Idaho
2 boilers: 412 hp. each: 100 lb.
2 boilers: 350 hp. each: 100 lb.
4 boilers: 250 hp. each: 100 lb.
2 boilers: 500 hp. each: 100 lb.

CHAIN GRATE STOKER

ADAMS & WESTLAKE CO.
Elcart, Indiana
2 boilers: 500 hp. each: 125 lb.

BETHLEHEM STEEL CO.
Bethlehem, Pa.
4 boilers: 600 hp. each: 160 lb.

THE BERYLLIUM CORP. OF PA.
Temple, Pa.
2 boilers: 22,500 lb./hr. each: 145 lb.

BLESSING HOSPITAL
Quincy, Illinois
1 boiler: 150 hp.: 100 lb.

CHICAGO, NORTHWESTERN R. R.
Chicago, Illinois
3 boilers: 45,000 lb./hr. each: 160 lb.

CLINTON PRODUCTS CO.
Clinton, Iowa
2 boilers: 25,000 lb./hr. each: 200 lb.

CORN PRODUCTS REFINING CO.
Pekin, Illinois
1 boiler: 175,000 lb./hr.: 400 lb.

HOUDAILLE HERSHEY CORP.
Decatur, Illinois
4 boilers: 25,000 lb./hr. each: 125 lb.

HOOSIER LAMP & STAMPING CORP.
Evansville, Indiana
1 boiler: 400 hp.: 150 lb.

MURRAY CORPORATION OF AMERICA
Scranton, Pa.
2 boilers: 35,000 lb./hr. each: 125 lb.

KREY PACKING
St. Louis, Mo.
1 boiler: 400 hp.: 350 lb.

ROCKFORD MITTEN & HOSIERY CO.
Rockford, Illinois
2 boilers: 400 hp. each: 110 lb.

U. S. RUBBER CO.
Passaic, New Jers
2 boilers: 40
2 boil

lb./hr. each: 125 lb.
32,000 lb./hr. each: 125 lb.

U. S. MARINE HOSPITAL
Klamaith Falls, Oregon
4 boilers: 500 hp. each: 100 lb.

REPUBLIC RUBBER DIVISION
Youngstown, Ohio
1 boiler: 65,000 lb./hr.: 450 lb.

ALUMINUM FORGINGS, INC.
Erie, Pa.
3 boilers: 50,000 lb./hr. each: 145 lb.

GRIESEDIECK WESTERN BREWERY
Belleville, Illinois
1 boiler: 600 hp.: 125 lb.

UNDERFEED STOKERS

EDWARD G. BUDD MFG. CO.
Philadelphia, Pa.
3 boilers: 100,000 lb./hr. each: 150 lb.

CHEVROLET MOTORS
Bay City, Michigan
1 boiler: 600 hp.: 150 lb.

INDEPENDENT PNEUMATIC TOOL CO.
Aurora, Illinois
1 boiler: 300 hp.: 300 lb.

THE OLD QUAKER CO.
Lawrenceburg, Indiana
2 boilers: 500 hp. each: 160 lb.

REO MOTORS, INC.
Lansing, Michigan
1 boiler 40,000 lb./hr.: 260 lb.

ST. JOHN'S HICKEY MEMORIAL HOSPITAL
Anderson, Indiana
2 boilers: 150 hp. each: 150 lb.

U. S. FINISHING CO.
Norwich, Conn.
1 boiler: 40,000 lb./hr.: 165 lb.

UPJOHN COMPANY
Kalamazoo, Michigan
1 boiler: 40,000 lb./hr.: 160 lb.

U. S. MARINE AIR STATION
Cherry Point, North Carolina
3 boilers: 55,000 lb./hr. each: 175 lb

MILITARY VEHICLE & FIN
Detroit, Michigan
3 boilers: 38,0

ING PLANT
lb./hr. each: 150 lb.

MBUS ASF DEPOT
Columbus, Ohio
1 boiler: 26,000 lb./hr.: 90 lb.

MUNICIPAL WATER & LIGHT PLANT
St. Marys, Ohio
2 boilers: 35,000 lb./hr. each: 235 lb.

TIMKEN ROLLER BEARING CO.
Columbus, Ohio
1 boiler: 60,000 lb./hr.: 400 lb.

U. S. MILITARY ACADEMY
West Point, N. Y.
2 boilers: 100,000 lb./hr. each: 160 lb.
1 boiler: 120,000 lb./hr.: 160 lb.

U. S. NAVY YARD
Charleston, S. C.
2 boilers: 20,000 lb./hr. each: 160 lb.

GEO. WIEDEMANN BWG. CO.
Newport, Ky.
1 boiler: 456 hp.: 125 lb.

REPUBLIC
Are Being
FOR ALL SIZES OF BOILERS AND

COMBUSTION CONTROL INSTALLATIONS

PULVERIZED COAL

BELTON MILLS
Belton, South Carolina
1 boiler: 60,000 lb./hr.: 250 lb.

BOECKELER ASSOCIATES
Trenton, Michigan
1 boiler: 528 hp.: 125 lb.

GEORGIA POWER COMPANY
Harryat, Georgia
1 boiler: 600,000 lb./hr.: 975 lb.

HARTFORD CITY PAPER COMPANY
Hartford City, Indiana
1 boiler: 80,000 lb./hr.: 325 lb.

CLINTON ENGINEERING WORKS
Oliver Spriggs, Tenn.
1 boiler: 750,000 lb./hr.: 1375 lb.

U. S. NAVY YARD
Portsmouth, Virginia
1 boiler: 120,000 lb./hr.: 380 lb.

WRIGHT FIELD
Dayton, Ohio
1 boiler: 100,000 lb./hr.: 300 lb.

N. Y., N. H. & HARTFORD R. R. CO.
Cos Cob, Conn.
1 boiler: 150,000 lb./hr.: 325 lb.

PRATT & WHITNEY
East Hartford
2 boilers:

Conn.
: 20,000 lb./hr. each: 175 lb.

U. S. MARINE BARRACKS
Quantico, Virginia
1 boiler: 120,000 lb./hr.: 125 lb.

CENTRAL ILLINOIS PUBLIC SERVICE CO.
Hutsonville Station
Hutsonville, Ill.
2 boilers: 150,000 lb./hr. each: 665 lb.

COMMONWEALTH EDISON CO.
Northwest Station
Chicago, Illinois
3 boilers: 425,000 lb./hr. each: 1325 lb.

NORFOLK NAVY YARD
Portsmouth, Va.
3 boilers: 120,000 lb./hr. each: 400 lb.

NORTHERN PAPER MILLS
Green Bay, Wis.
2 boilers: 75,000 lb./hr. each: 650 lb.

WILLIAMSBURG POWER PLANT
Brooklyn, N. Y.
2 boilers: 375,000 lb./hr. each: 875 lb.

OIL FIRED

BAY REFINING CORP.
Bay City, Michigan
1 boiler: 350 hp.: 245 lb.

FITCHBURG GAS & ELEC. LIGHT CO.
Fitchburg, Mass.
2 boilers: 120,000 lb./hr. each: 200 lb.

PHILADELPHIA NAVY YARD
Philadelphia, Pa.
2 boilers: 130,000 lb./hr. each: 175 lb.

U. S. NAVAL HOSPITAL
Oakland, California
5 boilers: 490 hp. each: 125 lb.

U. S. NAVAL MAGAZINE
Port Chicago, California
3 boilers: 210 hp. each: 125 lb.

U. S. NAVAL HOSPITAL
San Leandro, California
3 boilers: 500 hp. each: 125

CITIES SERVICE
Lake Charl
4 b

/hr. each: 250 lb.
,000 lb./hr. each: 250 lb.

GAS FIRED

BEECH AIRCRAFT CORPORATION
Wichita, Kansas
2 boilers: 180 hp. each: 100 lb.

GULF POWER COMPANY
Pensacola, Florida
1 boiler: 230,000 lb./hr.: 875 lb.

GENERAL TIRE & RUBBER CO.
Waco, Texas
3 boilers: 16,000 lb./hr. each: 190 lb.

LONG-BELL LUMBER CO.
De Ridder, La.
3 boilers: 250 hp. each: 165 lb.

MATHIESON ALKALI WORKS, INC.
Lake Charles, La.
1 boiler: 420,000 lb./hr.: 925 lb.

MISSISSIPPI POWER CO.
Hattiesburg, Mississippi
1 boiler: 230,000 lb./hr.: 875 lb.

TIDEWATER ASSOCIATED OIL CO.
Avon, California
2 boilers: 100,000 lb./hr. each: 250 lb.

ABERCRAMBIE-HARRISON OIL CO.
Sweeney, Texas
4 boilers: 100,000 lb./hr. each: 250 lb.

COMBINATION FIRING

CROWN CENTRAL PETROLEUM CORP.
Houston, Texas
3 boilers: 75,000 lb./hr. each: 450 lb.
Gas & Oil

KOPPERS UNITED CO.
Kobuta, Pa.
1 boiler: 150 hp.: 165 lb.
Coal & Oil

STANDARD OIL CO. OF NEW JERSEY
Canton, New Jersey
1 boiler: 150,000 lb./hr.: 605 lb.
Gas & Oil

CITY PUBLIC SERVIC
San Antonio, T
1 boiler
1

: 605 lb.

PUBLIC SERVICE BOARD
San Antonio, Texas
1 boiler: 275,000 lb./hr.: 200 lb.
1 boiler: 200,000 lb./hr.: 200 lb.
Gas & Oil

S & W FINE FOODS, INC.
Redwood City, California
1 boiler: 335 hp.: 105 lb.
Gas & Oil

UTAH OIL REFINING CO.
Salt Lake City, Utah
4 boilers: 65,000 lb./hr. each: 615 lb.
Gas & Oil

U. S. NAVAL OPERATING BASE
Norfolk, Va.
1 boiler: 125,000 lb./hr.: 400 lb.
Pulverized Coal & Oil

PENICK & FORD, LTD. INC.
Cedar Rapids, Iowa
1 boiler: 150,000 lb./hr.: 500 lb.
Gas and pulverized coal

STANDARD OIL CO. OF CALIF.
Richmond, Calif.
3 boilers: 125,000 lb./hr. each: 850 lb.
Gas, oil, acid sludge

LOUISIANA STEAM GEN. CORP.
(Gulf States Utilities)
Baton Rouge, La.
2 boilers: 500,000 lb./hr. each: 670 lb.
Natural gas, oil, pulverized cake, refinery byproducts

THE TEXAS CO.
Port Arthur, Texas
3 boilers: 300,000 lb./hr. each: 615 lb.
Oil and gas

REPUBLIC FLOW METERS CO.
2222 Diversey Parkway **Chicago 47, Illinois**

SUN "JOB PROVED" PRODUCTS CUT COSTS,

Sun products have been "Job Proved" in the lubrication of almost every type of mining, manufacturing, power, and transportation equipment . . . in refrigeration and air-conditioning . . . in metal cutting, tempering, and quenching . . . in the processing of textile fibers, leather, natural and synthetic rubbers . . . in the impregnation of electrical, electronic, and packaging materials of many kinds.

To help you solve your production problems, Sun Oil Company offers a wide selection of "Job Proved" petroleum products, plus the experience of Sun Engineers. Their know-how and detailed product information are yours for the asking. Call your local Sun office, or write Dept. P1.

SUN OIL COMPANY • PHILADELPHIA 3, PA.

In Canada: Sun Oil Company, Ltd., Toronto and Montreal

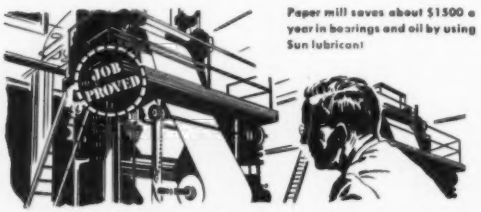
INDUSTRIAL OILS

SUNVIS 900 OILS—High-viscosity-index, paraffinic-type oils—of uniform O F pour point—fortified against rust, corrosion, oxidation, and sludge. The finest available lubricant for turbines, hydraulic systems, and similar applications.

SUNVIS HD 700 OILS—High-viscosity-index oils containing additives which minimize oxidation and give detergency. Ideal lubricants for internal combustion engines subjected to continuous heavy loads under the most adverse conditions.

SUNVIS OILS—Solvent-refined paraffinic-type oils of uniform high viscosity index, low pour point, and low carbon content. Especially suitable for application to long-time use in all types of industrial reservoirs and circulating systems.

DYNAVIS OILS—Low-pour-point, high-viscosity-index, inhibited oils, containing an additive which helps prevent formation of harmful corrosive and sludge-forming acids. Well suited for engines fitted with alloy bearings and operated at high temperatures.



Paper mill saves about $1500 a year in bearings and oil by using Sun lubricant

SOLNUS OILS—Well-refined straight mineral oils. Stand up under hard use for long periods of time. Recommended for use in machine tools, air compressors, certain types of diesels, etc.

CIRCO OILS—Used for general lubrication of industrial machinery when straight mineral oils are required.

SUNTAC OILS—100%-petroleum products which have been compounded to increase their adhesiveness. Recommended for general lubrication of all machines subjected to sudden shocks and load reversals. Cling to the parts to be lubricated.

STEAM CYLINDER OILS—High flash and fire point lubricants for either saturated or superheated steam conditions and for worm-gear speed-reduction units.

SUN CAR JOURNAL OILS—Dark oils meeting A.A.R. Specifications. For use in waste-packed bearings of railroad equipment.

SUN DELAWARE OILS—Dark oils for general lubrication on older types of industrial machinery.

SUNOCO WAY LUBRICANT—For use on tableways. Eliminates chatter and scoring . . . resists corrosion. Has good metal-wetting and adhesive properties, ample viscosity, and E. P. qualities.

SUN MARINE ENGINE OILS—Compounded with special emulsifying agents in order to provide adhesion to, and lubrication of, working parts in the presence of water. For the lubrication of bearings, eccentrics, crossheads, and various other parts of steam engines.

ROCK DRILL OIL—High-film-strength adhesive oil. For use in jackhammers, stopers, drifters, and similar equipment.

INDUSTRIAL GREASES

SUN CUP GREASES—Water resistant. For grease-cup and grease-gun application when service is normal.

SUN GUN GREASES—Smooth greases made with medium-viscosity oil. Stable under pressure in power and booster guns.

ADHESIVE PRESSURE GREASES—Won't drip or splash. Excellent lubricants for open-gear applications.

SUN DARK PRESSURE-SYSTEM GREASES—For power-driven central grease lubricating systems in heavy industries. Also used as a "medium cup grease."

SUN MINE CAR GREASES—Available in several grades. Suitable for both antifriction bearings and plain-bearing cavity-type wheels.

SUN MINING MACHINE LUBRICANT—Semifluid. For use where a light but adhesive grease is required. Resists separation and decomposition.

Chemical plant saves about $8000 per year by adopting Sun Pressure Grease

SUN ROLLER BEARING GREASES—For use on electric motors and generators and high-temperature machinery equipped with ball or roller bearings.

SUN GEAR COMPOUNDS—Black adhesive open-gear compounds and

"JOB PROVED" IN EVERY INDUSTRY

SUN PETROLEUM

SPEED PRODUCTION, IMPROVE QUALITY

wire-cable greases. Recommended for power presses, mining machinery, worn reduction mills, crushers, pump gears, etc.

SUNOCO TRACTOR ROLLER COMPOUND—For crawler-type tractors. Provides good lubrication with exceptional sealing qualities.

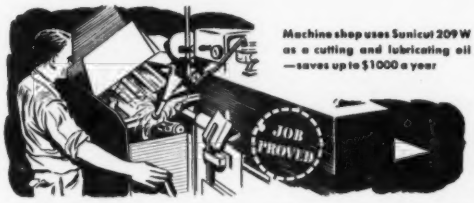
METALWORKING OILS

SUNICUT—Straight (non-emulsifiable) transparent cutting oils. Recommended for automatic screw machines and heavy-duty machining operations. Permit high speed production with excellent finishes, long tool life.

SUNOCO EMULSIFYING CUTTING OIL—A self-emulsifying oil which produces a stable white emulsion. Efficient and economical cooling and lubricating medium for turning, milling, drilling, and other metalworking operations on both ferrous and nonferrous metals. It is also an excellent grinding coolant.

SUN QUENCHING OILS—Specially refined oils designed to aid development of maximum physical properties in a wide variety of steels.

SUN TEMPERING OILS—Specially refined oils for tempering steel. Because of their low carbon content and stability under heat, these oils have an unusually long service life.



Machine shop uses Sunicut 209 W as a cutting and lubricating oil —saves up to $1000 a year

SUN ROLLING OILS—Straight and emulsifying oils which will permit maximum production in rolling steel, aluminum, brass, and copper.

SUN ANTI-RUST COMPOUNDS—Petroleum-base oils with chemical additives designed to prevent the rusting and corrosion of steel.

REFRIGERATION OILS

SUNISO REFRIGERATION OILS—Have extremely low pour points, extremely low wax-separating characteristics, a high degree of stability and long life. Initially neutral and resistant to formation of detrimental acids under service conditions. Suniso Oils are high quality oils suitable for both high- and low-temperature operations. The most widely used oils in refrigeration and air-conditioning.

Sports arena steps up compressor efficiency 15% by switching to Suniso Oil

TEXTILE-PROCESSING OILS

SUNOTEX TEXTILE OILS—Designed to impart certain additional properties to various forms of fibers during their processing from the fiber state into a manufactured product. All Sunotex textile oils are emulsifiable in water. Highest rating in fadometer tests.

SUN COTTON CONDITIONING OILS—Pale mineral oils which condition the cotton. They prevent waste by cutting down excessive amounts of "fly" (fine air-borne lint particles).

Worsted mill obtains easier scouring, better quality, larger yield with Sunotex WO-220

SUN ASBESTOS FIBER CONDITIONING OIL—Used for spraying on the asbestos during processing. Fibers are kept from being damaged or broken down, and harmful dust is minimized when this product is used.

SUN CORDAGE OILS—Generally used alone, but are adaptable to various formulas used by cordage manufacturers. Selected products, highly compatible with additives.

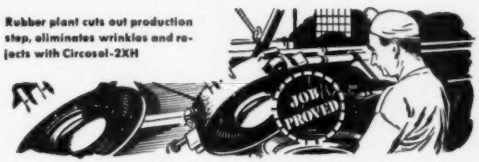
RUBBER-PROCESSING AIDS

CIRCOSOL-2XH—An elasticator and processing aid for natural rubber and especially for GR-S. Outstanding for sponge rubber.

CIRCO LIGHT PROCESS AID—A processing agent and excellent softener for natural rubber, natural rubber reclaims, and neoprene synthetic rubber. Used for GR-S to some extent.

SUNDEX-54—An inexpensive product suitable for processing GR-S and blends of GR-S and natural rubber. An established processing aid for rubber footwear stocks and semihard rubbers.

Rubber plant cuts out production step, eliminates wrinkles and rejects with Circosol-2XH



CIRCOMAR-5AA—A black-colored product for processing natural and GR-S rubber used in tire-making. Also used in reclaiming natural-rubber scrap. Replaces asphalt fluxes. Free-flowing at room temperature.

WAXES

Sun's new wax plant will be completed in 1949. Its many refining innovations and extreme flexibility will permit new types of waxes to be manufactured in large quantities—a procedure heretofore impracticable. A wide range of fully refined paraffin and microcrystalline waxes will be "tailor-made" to meet the requirements of virtually all major industrial applications. Pilot plant samples of several grades are now available.

MISCELLANEOUS INDUSTRIAL PRODUCTS

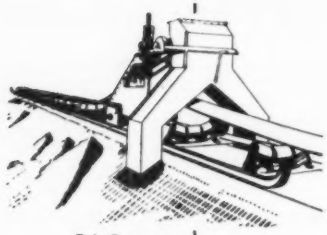
SUN SOLVENTS—Sun Spirits for the thinning of paints, varnishes, and enamels, and for metal-cleaning . . . a pure, water-white petroleum solvent free of corrosive sulphur. Other Sun solvents with special properties are available for the chemical industry.

SUN LEATHER OILS—Mineral-base leather oils. Used for obtaining the desired tensile strength, proper temper, and controlled moisture content. Maintain a light even color . . . mix well . . . distribute evenly.

"JOB PROVED" IN EVERY INDUSTRY

PRODUCTS SUNOCO

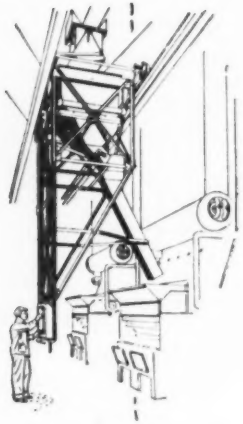
Is "Materials Handling" a Profit Thief in Your Operation?



Belt Conveyor Tripper

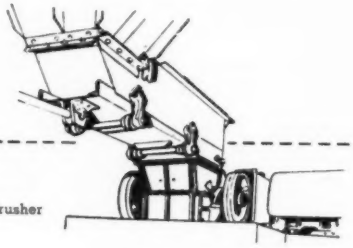
Bulk materials handling systems built years ago for a particular set of conditions may be "getting by" under new conditions and products.

Perhaps many of today's production difficulties can be traced to plant layout, cost accounting, or peculiarities of your particular operation. But, remember, it is *often* materials handling.



Weigh Larry

Let us make a pretty responsible statement: ***In about 8 out of 10 operations, some saving can be made by reviewing the handling of bulk materials.*** Stephens-Adamson engineers are available to assist. They represent a staff thoroughly experienced in applying every type of conveyor, elevator, and hoist from the *complete* S-A Line to every type of bulk material and plant layout. Let us talk this over with you — say so in any convenient way — phone, wire or letter.



Ring Type Crusher

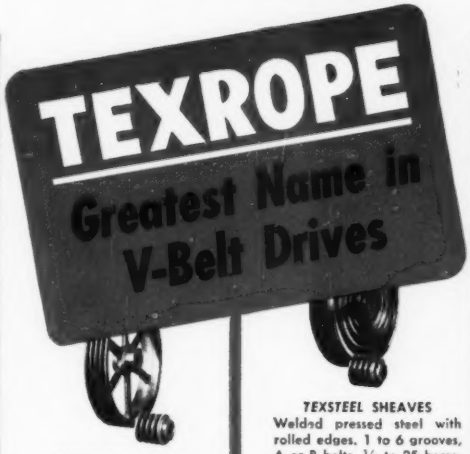
STEPHENS-ADAMSON MFG. CO.

5 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

Fills Every Need for V-Belt Drives!

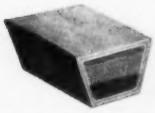


***TEXDRIVE* SHEAVES**
Cast iron with 1 to 6 grooves for A and B belts. 1 to 25 h. p. *All sizes from stock.*

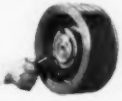
***VARI-PITCH* WIDE RANGE SHEAVES**
Speed range up to 100%. 1 to 4 grooves, Q and R belts, fractional to 30 horsepower. Delivery good. *Call your nearest District Office or Texrope dealer.*

***TEXSTEEL* SHEAVES**
Welded pressed steel with rolled edges. 1 to 6 grooves, A or B belts, ¼ to 25 horsepower. *All sizes from stock.*

STANDARD CAST IRON SHEAVES
Made to order from stock patterns. 1 to 14 grooves, A, B, C, D, or E belts. 1 to 1000 horsepower. Delivery good. *Call your nearest District Office or Texrope dealer.*



***TEXROPE* SUPER-7 V-BELTS**
Wide range of types, sizes and sections to suit all operating conditions. *All standard sizes from stock.*

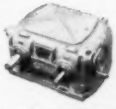


MAGIC-GRIP SHEAVES
Semi-steel with patented taper bushing. On and off in a jiffy. 2 to 12 grooves, B, C, or D belts, 2 to 250 horsepower. *All sizes from stock.*

SPECIAL CAST IRON AND STEEL SHEAVES
Any number of grooves for A, B, C, D, or E belts. Up to 6000 horsepower. Delivery good. *Call your nearest District Office or Texrope dealer.*

***TEX-IRON* SHEAVES**
Light weight single groove sheave for fractional horsepower applications. *All sizes from stock.*

***VARI-PITCH* STANDARD SHEAVES**
Speed range 9% to 28%. 2 to 10 grooves, A, B, C, D, or E belts, 1 to 300 horsepower. Stationary or Motion Control. Delivery good. *Call your nearest District Office or Texrope dealer.*



***VARI-PITCH* SPEED CHANGERS**
Speed range to 375%. 1½ to 75 horsepower. Single handwheel controls speed. Delivery good. *Call your nearest District Office or Texrope dealer.*

Best Delivery in the Industry!

NOW YOU CAN GET nearly every standard V-belt drive component from Texrope stocks. Even on non-stock items, Texrope delivery is the best in the industry. And Texrope is the *only* brand that meets *every* V-belt need.

Selecting a drive is as easy as looking up a telephone number in the 144 page Texrope Pre-Engineered Drive book. Covers 90% of all V-belt drives. Write today for Bulletin 20 B 6956 or see your nearest Allis-Chalmers Authorized Dealer or District Office. Also listed in Sweet's.

ALLIS-CHALMERS, 952A SO. 70 ST. A 2546
MILWAUKEE, WIS.

Texrope, Super-7, Vari-Pitch, Magic-Grip, Tex-Iron, Texsteel and Texdrive are Allis-Chalmers Trademarks.

Texrope Super-7 V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices.

ALLIS-CHALMERS

Originators of the Multiple V-belt Drive for Industry

Edward

Motor operated angle stop valve (above) and globe non-return valve with Impactor handwheel and Equalizer (right) are typical of complete line of Edward pressure-seal bonnet valves for America's most modern high-pressure high-temperature power plants.

PRESSURE-SEAL VALVES

GIVE YOU THESE VITAL ADVANTAGES

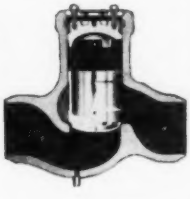
STOP

Edward pressure-seal stop valve of new streamlined globe design for lowest pressure drop.

NON-RETURN

Positive action angle non-return valve with new Edward hi-lift disk-piston and Edward Equalizer.

CHECK



New easy-opening, non-slamming pressure-seal check valve in globe pattern. Also built in angle pattern.

GATE VALVES ALSO AVAILABLE

- ***LASTING TIGHTNESS AT ANY TEMPERATURE***
  No bonnet joint leakage regardless of temperature or pressure variations.
- ***LOW MAINTENANCE—EASY DISASSEMBLY***
  No flanges, gaskets or bolting to restress periodically . . . Greatly simplified disassembly and reassembly . . . maximum part interchangeability.
- ***FULL LINE OF TYPES AND PRESSURES***
  Globe and angle stop, non-return and check valves and gate valves available in 900, 1500 and 2500 lb. pressure classes.
- ***UP TO 30% MORE FLOW***
  New body designs make use of smaller pipe and valves possible, cut pressure loss, save space, reduce weight, cut wear-producing turbulence.
- ***OTHER EDWARD DESIGN ADVANTAGES***
  Patented EValthrust yoke bushing and impactor handwheel standard equipment . . . Edward Equalizer on non-return and check valves for full disk opening even at low loads . . . smaller internal diameters—no parts to insert . . . proved materials for top temperatures.

Write for new Catalog

AN EXTRA *EXCLUSIVE* EDWARD FEATURE

Ordinary valves with welded-in seat rings, by their design, put high stress concentrations on critical areas of the valve body, often causing cracking where there is low strength. Note in the drawing how the new Edward Intex seat designs avoid this. The hard-facing material, which forms the seat, is laid directly on the valve body and absorbs closing loads, reducing distortion and the shearing effect of high stress concentrations.

Edward Valves, Inc.

Subsidiary of Rockwell Manufacturing Company, EAST CHICAGO, INDIANA

EDWARD VALVES, Inc.
1220 West 144th Street, East Chicago, Indiana

Please send me your new folder 12-H on Edward Pressure-Seal Valves.

Name_____

Company_____

Street_____

City_____ Zone_____ State_____

WATER COOLING TOWERS

Heavy Duty Construction, individually engineered for every installation. Interiors of redwood, with outside casing of wood, steel, transite or masonry to harmonize with building construction. Guaranteed water cooling performance and guaranteed to withstand hurricane winds up to 100 M.P.H. Send for Catalog No. 145.

C. H. Wheeler

Repeat Order for Dual Bank C. H. Wheeler Condenser At Hagood Station

After operating their original C. H. Wheeler "Dual Bank" Steam Condenser at Hagood Station for about a year, the South Carolina Power Co. ordered a duplicate, which is now under construction. They are both 20,350 sq. ft. surface condensers with a divided water box, which, of course, permits half the condenser to operate while the other half is being cleaned. "Dual Bank" tube arrangement gives a wide central lane with branches which permits deep penetration of the entering steam into the tube nests. Condensate temperatures and pressures equal those at the steam inlet; further, the high heat transfer closely approaches the theoretical "ideal" in overall efficiency. . . . Note the two C. H. Wheeler Circulating Water Pumps in the foreground; also the C. H. Wheeler Tubejet Air Ejector in the photo in the lower right, which is also a part of this Hagood installation. . . . Seven exact duplicates of this unit are installed in other plants. . . . Send for the Condenser Catalog No. 1461, which also describes Circulating and Condensate Pumps and Steam Jet Air Ejectors.

C. H. WHEELER MFG. COMPANY
1800 Sedgley Avenue, Phila. 32, Pa.
REPRESENTATIVES IN MOST PRINCIPAL CITIES

STEAM JET EJECTORS

Single and Twin Two-Stage Tubejets with Surface Inter-, After Condenser for power plant use; also Two-Stage Tubejet with Surface Inter-After or After Condenser for replacing mechanical wet vacuum pump on existing "Wet Type" Surface Condensers. Catalog No. 1462 describes these and One- to Five-Stage Tubejets for process applications. Send for a copy.

STEAM CONDENSERS • WATER COOLING TOWERS
EJECTORS • STEAM JET VACUUM REFRIGERATION
OF PHILADELPHIA

POWELL VALVES start their

Fig. 559—125-pound Iron Body Bronze Mounted Swing Check Valve. Flanged ends, bolted flanged cap and regrindable, renewable bronze seat and disc. Disc, when wide open, permits full unobstructed flow through valve body

Fig. 11323 W. E.—Class 1500-pound Cast Steel Flangeless Bonnet Gate Valve with welding ends. Has top-mounted electric motor operator for quick, positive opening and closing by remote control.

Fig. 1793—Large 125-pound Iron Body Bronze Mounted Gate Valve. Made in sizes 2" to 30", inclusive. Has outside screw rising stem, bolted flanged yoke and tapered solid wedge. Tapered double wedge can be provided in sizes 2" to 12", inclusive.

Fig. 11393 W.E.—Class 1500-pound Cast Steel Flangeless Bonnet Angle Valve with welding ends. Toggle operated.

Powell Cast Steel Valves of all types are available in pressure classes from 150 to 2500 pounds, inclusive.

POWELL

103rd year of service to Industry

—and the Powell record of satisfactory performance through all the past years is your guarantee for the future.

A century is a long time to concentrate on making valves—and nothing but valves. But it's not only important *how long* you've been doing something but also *how well*.

The fact that, in all these years, Powell has never failed to produce the *right* valves to satisfy every industrial need, is real "service."

As we start our 103rd year, there's a Powell Valve of correct design *and material* for every one of your flow control requirements. And, as new conditions bring new demands, there will be Powell Valves to meet them.

Fig. 19031 W.E.—New Class 900-pound Cast Steel, Flangeless Bonnet, Streamlined Pattern, Globe Valve with welding ends and spur gears. (Shown with gear cover removed). This improved design reduces pressure drop and turbulence to the minimum.

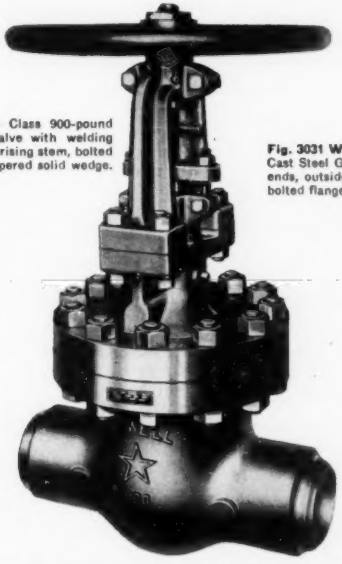


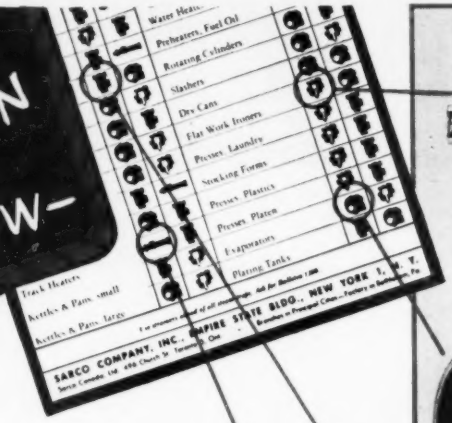
Fig. 9003 W. E. — Class 900-pound Cast Steel Gate Valve with welding ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.

Fig. 3031 W. E. — Class 300-pound Cast Steel Globe Valve with welding ends, outside screw rising stem and bolted flanged yoke.

The Wm. Powell Company
Cincinnati 22, Ohio
DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

VALVES

WHAT EVERY YOUNG MAN SHOULD KNOW—



About

STEAM TRAPPING

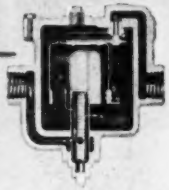
In your industry, you will some day come face to face with the steam trap —a device that lets condensate and air out and keeps the live steam in.

You will need to know that no one type of trap is good for everything and that a separate trap should go on each steam coil. You will learn that several considerations always enter into the selection of the type best suited for a given application. Any one of its special features may be of primary importance to you and should influence your choice.

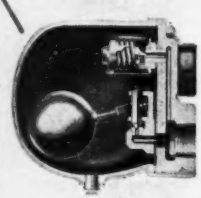
The experience of years on this subject has been condensed into a four page bulletin with a table showing where each trap is best. Ask for Catalog No. 1600 (on your School or Company letter-head, please).

●

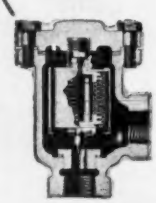
AND FOR THE EXPERT, this Bulletin together with the Sarco Hook-Up Book should be in your files. If you give us an outline of your type of business, a complete set of the Sarco reference data will be sent you as a single book.



BUCKET STEAM TRAP



FLOAT STEAM TRAP



No. 9 STEAM TRAP

SARCO No. 87 STEAM TRAP

245

SARCO

SAVES STEAM

SARCO COMPANY, INC.

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COST-CUTTERS YOU CAN DEPEND ON!

Worthington Turbine-Generators Set The Pace For Economical, Trouble-Free Operation

Two Worthington 2500 kw, 3600 rpm, 13,800 volt, 3-phase, 60 cycle Turbine-Generator Units at the Kaiser-Frazer plant in Willow Run, Michigan. They operate on steam at 250 lb. initial pressure, 470° F. total temperature, and exhaust at 27½" vacuum. Steam is automatically extracted at pressures from 15-50 lb. Installed in 1941, these Worthington Units supply both electric power and extracted steam for plant heating.

Worthington builds Turbine-Generator Sets in sizes up to 7500 kw, and in all types—including straight condensing, straight non-condensing, extraction, mixed pressure, mixed pressure extraction, low pressure and high back pressure.

Throughout industry these units are generating lower cost power, requiring only minimum maintenance, chalking up records of 99% — and better—for continuous operation, year after year.

IN YOUR OWN PLANT

Worthington engineers will be glad to study your power requirements, and to give you an estimate of the savings possible with the Worthington Unit that best meets your particular needs.

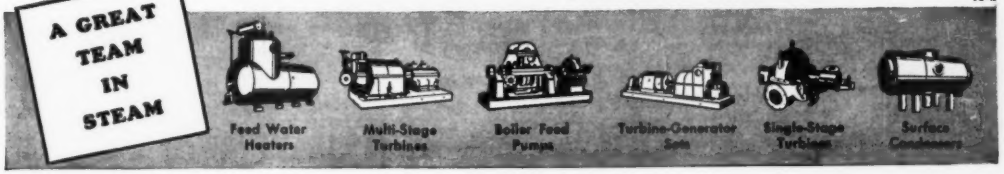
For further details proving *there's more worth in Worthington*, call your nearest Worthington District Office, or write to *Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y.*

WORTHINGTON

Steam Turbines

TB-2

A GREAT TEAM IN STEAM



KNOCK-OUT

BULLETIN 2022 ▶
"Brown Flow Meters for Cost Accounting," is complete and informative. A copy will be sent to you upon request. Write today!

STEAM WASTE

with Brown

Flow Accounting Meters

Your costs for distribution and utilization of steam (or other fluid) will be known facts with the installation of Brown Flow Accounting Meters. Hourly and daily records from your Brown Flow Meters will enable you to know, not approximate, what is happening . . . where it is happening . . . when it is happening. You can deal a knock-out blow to waste and properly pro-rate expenses for each operation and each department. The Brown Flow Accounting System is producing sensational economies in many plants, repaying the original investment in a very short time.

Check, today, on the application of Brown Flow Accounting Meters to your processes! You can get detailed information in Bulletin 2022 . . . send for your copy!

Brown Recording Integrating Flow Meters are not expensive! For example, a complete unit for a six inch steam line costs less than $500.00!

MINNEAPOLIS-HONEYWELL REGULATOR CO.
BROWN INSTRUMENTS DIVISION
4490 Wayne Ave., Philadelphia 44, Pa.
Offices in principal cities of the United States, Canada and throughout the world

BROWN *Advanced Instrumentation* FOR BETTER PROCESSING

Product of MINNEAPOLIS Honeywell

Equipment by

for CONTROL SYSTEMS

Hagan pioneered in the field of automatic combustion control systems for both stationary and marine boilers—and still leads. Engineering of these and other control systems is one of Hagan's major activities, but the components of these systems are suitable for many other applications, and may be purchased separately.

for FLOW MEASUREMENT

The Hagan Ring Balance Flow Meter is a rugged and accurate instrument, adapted for a wide range of static and differential pressures. Calibration is the same for dry or wet service; range changing is exceptionally easy. Suitable for water, steam, air, gas, oil, and other fluids. *No stuffing boxes.* Calibration by dead weight method checks or takes the place of water column methods. Photos show a few typical models of this meter.

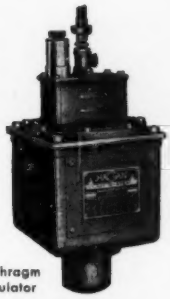
for FORCE MEASUREMENT and other purposes

As designers of control systems, Hagan engineers have on many occasions encountered problems which required the development of special equipment. Some of this equipment has proved to have a wider field than the original application, and has been made commercially available. Several such units are shown here.

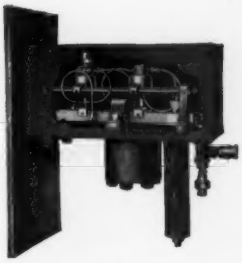
• • •

For full information on any of this equipment and its application to your specific problems, write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

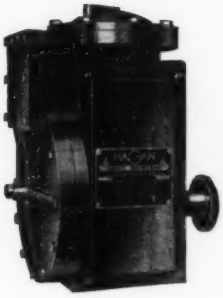
HAGAN



Diaphragm Regulator

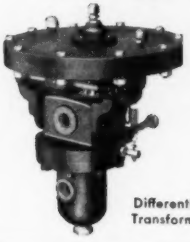


Type "F" Master Sender

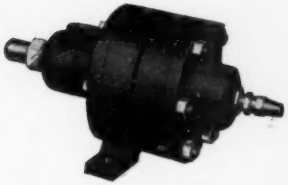


Variable Ratio Regulator

Receiving Regulator



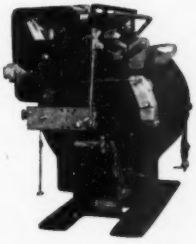
Differential Transformer



Type "F" Totalizer

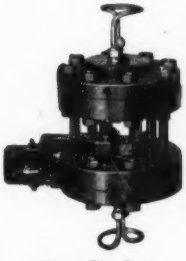
Ring Balance Flow Meter (Indicating, Integrating & Recording)

Ring Balance Flow Meter (Integrating & Recording)



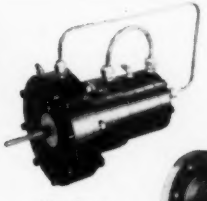
Dual Meter with Integrator (Case Removed)

Single Ring Meter without Integrator (Rear View)

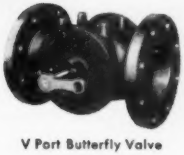


Hagan ThrusTorq

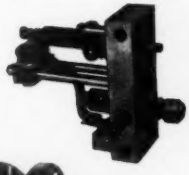
Steam Separator



MicroServo



V Port Butterfly Valve



MicroTrans

Thermostat

HAGAN CORPORATION

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

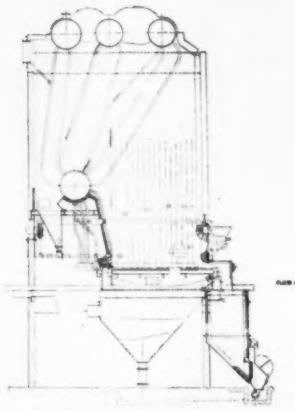
HERE'S PROOF

of Æ Perfect Spread Stoker's PERFORMANCE! DEPENDABILITY! LOW-COST OPERATION!

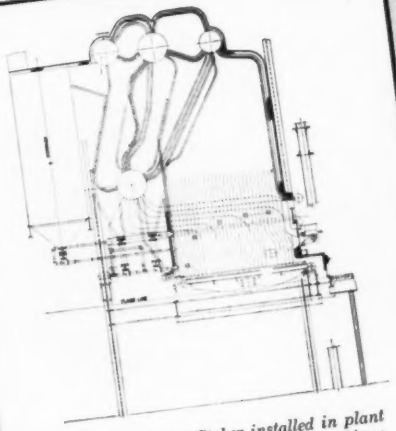
Recognized for over 20 years as a highly efficient, economical stoker, the Perfect Spread Stoker is backed by American Engineering Company's 45 years of combustion engineering experience. Check the recent contracts listed below and write to us today for the names of other industrial and commercial plants which have purchased Æ Perfect Spread Stokers . . . to get more steam at lower cost.

YOU CAN HAVE

WITH AN



Æ Perfect Spread Stoker installed in Michigan plant of large automobile manufacturer. Four units 70,000 lb/hr. capacity. Installed under Wickes Boilers.



Æ Perfect Spread Stoker installed in plant of large manufacturing plant in Michigan • Two units 21'0" by 17'3" installed under B&W boilers. Capacity each 180,000 lb/hr.

SOME RECENT CONTRACTS FOR Æ PERFECT SPREAD STOKERS WITH CONTINUOUS ASH DISCHARGE

4 units	70,000 lb./hr. each—	*Flint, Michigan*
2 units	60,000 lb./hr. each—	*Saginaw, Michigan*
4 units	80,000 lb./hr. each—	*Cleveland, Ohio*
2 units	180,000 lb./hr. each—	*Pontiac, Michigan*
2 units	60,000 lb./hr. each—	*Kalamazoo, Michigan*
1 unit	60,000 lb./hr. —	*Oaks, Pennsylvania*
2 units	38,500 lb./hr. each—	*Marion, Ohio*
2 units	70,000 lb./hr. each—	*Long Island City, New York*
1 unit	30,000 lb./hr. —	*Indianapolis, Indiana*
1 unit	70,000 lb./hr. —	*Lock Haven, Pennsylvania*

A PRODUCT OF . . .

MORE STEAM AT LOWER COST—AUTOMATICALLY

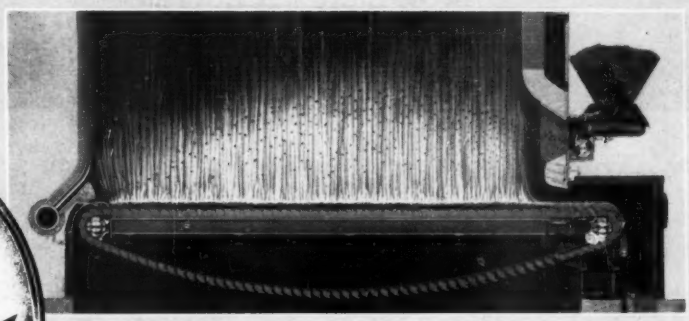
Æ PERFECT SPREAD STOKER

(CONTINUOUS ASH DISCHARGE)

Even using the lowest grades of coal you can get more steam . . . at lower cost, with the new, improved, streamlined Æ Perfect Spread Stoker. It operates perfectly feeding wet, dry, or partially frozen coal . . . without clogging . . . an exclusive Æ Perfect Spread feature. Fuel is spread evenly over the grate and a perfect bed maintained by the unique Æ fuel distributing overthrow rotor. Ashes are removed completely automatically by the traveling grate which handles high or low ash coals with equal ease.

If you want real freedom from fuel worries and maintenance problems, and if you want more steam at lower cost *now;* it will pay you to send for the Æ Perfect Stoker Bulletin. Leading power plants throughout the nation are installing Æ Perfect Spread Stokers (some recent contracts are listed in this ad). Act now to save fuel, and end high cost steam production —write for more information today.

FREE—Send for this informative bulletin now.



The Æ Perfect Spread Stoker—for requirements from 40,000 to 200,000 lbs. of steam per hour and upwards.*
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Won't Clog on Wet Coal!

PERFECT SPREAD STOKER

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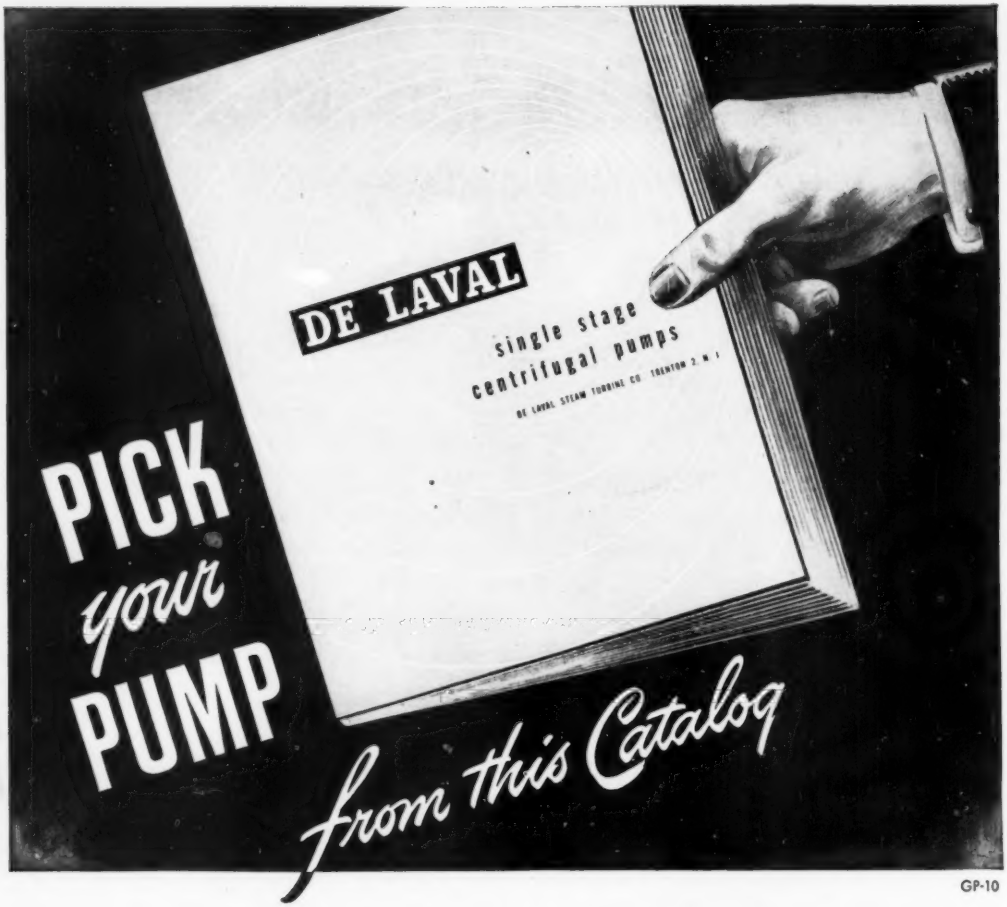


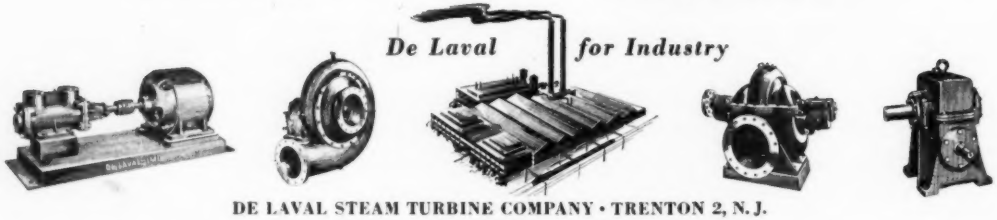
GP-10

COMPLETE WITH RATING TABLES AND DIMENSIONS

The text explains and illustrates features of design that you should look for when buying a pump. The simplified rating tables list pump and motor sizes for delivery and head requirements ranging from 150 gpm and 30′ head to 5000 gpm and 250′ head. The dimension drawings provide all information necessary for preliminary installation layouts. Ask for catalog GP-10.

DE LAVAL

De Laval for Industry



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POWER

JANUARY 1949 VOLUME 93, NUMBER 1

A CROSS-INDEX OF SUBJECTS FOR THE MONTH

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PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

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NEW METHODS BRING "SPECIAL-MOTOR" SMOOTHNESS TO STANDARD MOTORS

Motors have been made in much the same way for many years, until Westinghouse—with many years of leadership in a-c motor developments—departed from "tradition" in electric motor concepts, and built the Life-Line.

Motor-making traditions have been broken by the basketful. Users were surveyed to find what they wanted in standard motors that they were not getting. Life-Line motors were designed and built from scratch—by new methods and new tools in a totally new plant—to include these features.

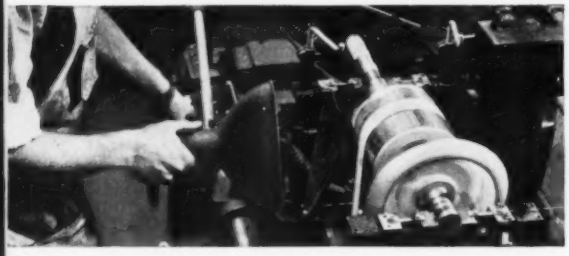
Quieter operation was one feature motor users asked for. It's important in many places—fans, blowers, air conditioning. Life-Line motors provide it. Life-Line ventilating design limits "windage" noise. New manufacturing techniques that insure absolute alignment and accuracy of fit, reduced vibration. The result is a *standard* motor with the quietness and freedom from vibration evidenced in the dramatic demonstration shown opposite. Modern tests check every motor for accuracy in manufacture.

You will want full details on other Life-Line features—its solid steel construction—freedom from lubrication for 5 years or longer—new compactness and light weight. Life-Line motors, now built in sizes from 1-15 hp, are available in standard and near-standard types from stock. Other sizes and types—up to 200 hp—will soon be changed over to modern Life-Line design. Check your nearest Westinghouse office for deliveries—or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21457

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Life-Line motors

MEASURED—WITH AIR New extreme accuracy for checking diameters of shafts and bearing bores is made possible by this precision gauge. Size is checked by any variations in air stream escaping between the part being checked and the master gauge.



EVERY UNIT BALANCED. *Every* Life-Line rotor—not random samples—is balanced on a Dynetric balancing machine* to insure maximum possible freedom from vibration of every unit.
*Reg. U. S. Pat. Off.

MOTOR "ASTHMA" CHECK. Sounds that shouldn't be there don't get by this "noise detective". Audiometer tells noise wave length; sound level meter (left) checks decibel rating; sound analyzer (right) tells the relative amount of different frequencies resulting.

Life-Line

SMOOTH? HERE'S PROOF! Coin balanced on edge on a Life-Line motor remains undisturbed as motor is started, runs and stops—dramatic evidence of Life-Line's freedom from vibration and resulting noise!

Specifications for boiler room piping not only determine what pipe shall be installed—but also determine how soon expensive failures will make re-installation necessary.

With maintenance costs as they are today, the pipe that lasts the longest invariably costs the least—and so, in the new power plant at Lawrenceville School, Lawrenceville, N.J., maximum durability was a primary aim. In all water lines, all condensate lines, all return lines, discharge lines, feed water lines to softeners and suction lines to boiler feed, Byers Wrought Iron pipe was installed. Stewart A. Jellett Co., Philadelphia, Pa., consulting engineers, were responsible for these sound specifications.

DEMONSTRATED PERFORMANCE

Every engineer will recognize the corrosion hazard that is present in each of these services. And many engineers, from all sections of the country, can certify from personal experience how effective wrought iron is in combating the conditions. In a number of reported cases, wrought iron has doubled, tripled and even quadrupled the useful life previously obtained from low-first-cost piping materials, and ended maintenance headaches that had been regarded as incurable.

UNIQUE MATERIAL—UNIQUE PROPERTIES

Wrought iron offers unique service qualities, because of its unique composition and structure. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and "detour" corrosive attack, thus discouraging pitting and local penetration. In addition, the fibers anchor the initial protective scale, which shields the underlying metal.

BOOKLET ON REQUEST

The best guide in applying wrought iron is not just a list of current uses, but an understanding of just what wrought iron is, how it is made, and why it resists corrosion. The story is condensed in the booklet, "The ABC's of Wrought Iron", which we will be happy to send you on request.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N. Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

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GENUINE WROUGHT IRON
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ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • JANUARY • 1949 • ESTABLISHED IN 1882

1000 Manpower for One Wage

TODAY, ONE MAN'S WAGE will buy 1000 manpower. Check it for yourself: What is the average hourly wage in some nearby factory? What does power cost at the plant busbar? Won't this hourly wage buy somewhere around 100 kilowatt-hours? And won't 100 kilowatts, fed to a motor, turn out 100 horsepower plus?

All that's left is to test the assumption that a horsepower can do as much work as ten men. Isn't that reasonable, remembering that one horsepower is 550 foot-pounds of work per second, or 33,000 per minute?

Many years ago, when man still lived by the sweat of his brow, the great engineer Rankine clocked laborers on various types of work. He noted what average forces they exerted over a period of eight hours, and how far they lifted or pulled per second. Rowing and windlass turning were the only kinds of labor where the worker could maintain the nominal tenth horsepower output, he found.

It took 18 men to turn out a horsepower when weights were hoisted by block and fall. Lifting by hand took 22 men, and carrying loads upstairs, 30 men. It took 60 men pushing dirt in wheelbarrows up a slope, and 70 shoveling dirt.

If you happen to hail from Missouri, why not test your own power rating by an hour of lifting, crank turning or shoveling? When you finish the stint—if you do—you will agree that few workers today deliver more than a minor fraction of a tenth of a horsepower. And from this, you will conclude that one man's wage today will buy far more than 1000 manpower even where wages are lower than average and power rates higher.

That's why management can no longer afford to hire men regularly to do any pushing, pulling or lifting a machine could perform. That's why looms run faster, machine tools rip off more metal per hour, and all production machines carry bigger and bigger motors. Every extra horsepower placed in the hands of the worker adds the output of 10 hand workers.

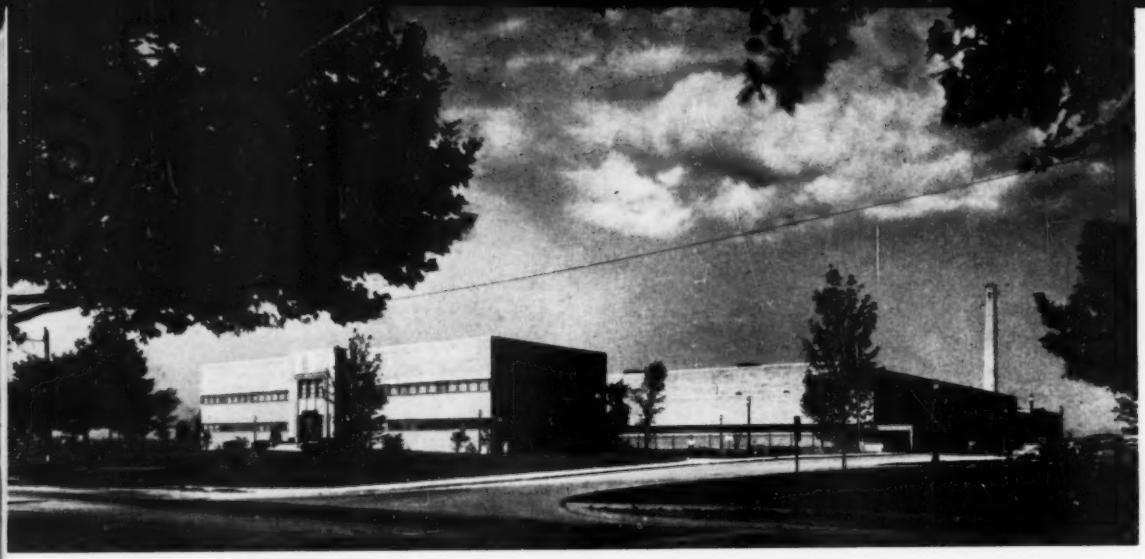
Or here is another way to state it: Let's say you are the big boss. You hire a high-priced man to operate a production machine. To get your money's worth out of the man's wage you power the machine with a 100-hp motor and pay a second equal wage, so to speak, for electricity. For this double wage, the electrical power, guided by the man, delivers as much output as 1000 sweating slaves—and nobody even gets very tired.

Here, indeed, is the secret of America's superlative living standard—immense production per worker, not by sweating but by arming him with great physical power, so every man becomes a giant in his capacity to produce food, clothes and the other good things of life.

Some will say that the owner uses more power per worker not from any altruistic motive, but merely to survive and make a profit in competition with other go-getting managers who can do likewise. If so, it merely proves that the competitive system of free enterprise is working as intended.

Whatever the motive for giving each worker more power in factory, farm and transportation, the result is always the same—increased average production. And average production equals average consumption, which is merely another name for standard of living.

In the last analysis it is horsepower that stands between the comfortable living of America and the half-empty rice bowl of the Chinese coolie.



1 A total of twelve different utility services, including three gases—oxygen, nitrogen, hydrogen—for special process use, feature plant layout. All services except electricity, reach the manufacturing area in color-coded piping, aiding maintenance

Modern Electronics Plant Uses All

Manufacture of precision electronic equipment requires complete power services, readily available. Here's an excellent illustration—from closely conditioned air to ample outlets for all services—at Western Electric's Allentown, Pa. plant

▶ POWER AND THE POWER SERVICES make up one of industry's most important tools. Latest example of how this tool can be put to most effective use appears in the recently completed, thoroughly planned and integrated electronics plant of Western Electric Co in Allentown, Pa., Fig. 1. In the main building, manufacturing operations revolve around a 325x400-ft electronics assembly floor. Under this center, at ground-floor level, are the machines for parts' production of heavy pieces, shipping and store rooms, and an electronics-development laboratory conducted by Bell Laboratories—all occupying a 375x450-ft area. Surrounding the main assembly floor is a 25-ft-wide section, housing process areas, supervisors' offices, locker rooms, washrooms and, in the north-west corner, an 8750-sq-ft cafeteria. In addition to service buildings there is a 2-story administration building.

Just what does this building layout represent in load on the plant's power services? First of all it requires practically all the services ordinarily within the province of the power plant, plus a few special ones peculiar to the manufacture of this company's electronics material.

Of the usual power services, the plant has (1) 10,000-kva electrical load, about 4500 of which is fluorescent lighting (2) 63,000-lb-per-hr steam capacity—major demand is for process and building heating (3) air-conditioning requirement met by 3720 gal per min of chilled water from three 770-hp compressors (4) need for 1000 gal of softened city water per min (5) chemical waste-disposal system up to 200 gpm for discharging process waste in harmless fashion to the Lehigh River.

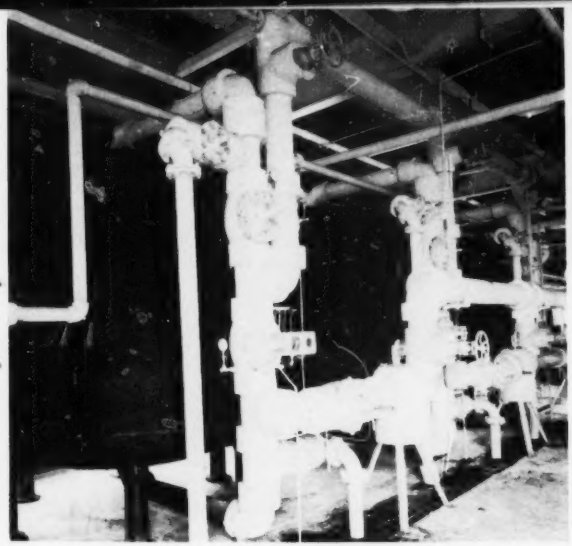
Special plant-manufacturing processes require, in addition to the above power services, a gas-generation plant capable of producing per hr 1800 cu ft of hydrogen, 2400 cu ft of oxygen, 2500 cu ft of nitrogen.

The Services for Power. The utilities building houses most of the equipment to furnish power services to the manufacturing and administration buildings. Chief exceptions are (1) 66-kv outdoor substation (2) gas-generating station (3) chemical-waste disposal plant.

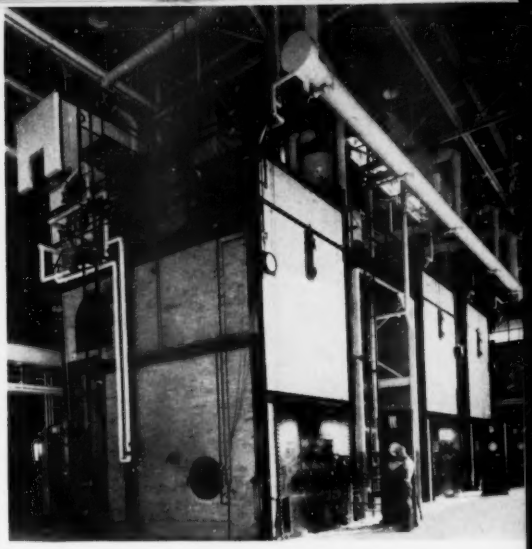
Electrical energy is purchased from the local utility, the Pennsylvania Power & Light Co, and comes in at 66 kv through an outdoor substation containing two double-winding 5000-kva 3-phase 60-cycle delta-connected transformers. These transformers step down the energy to 12,470 v, wye, for distribution through the plant electrical load centers.

Seven such centers, on the ground floor of the manufacturing building, supply both light and power for manufacturing and office use. Distribution lines are at 208 and 120 v. All busbars and conduit as well as duct work and piping run overhead in the ground-floor area of the manufacturing plant or, in other words, just below floor level of the main manufacturing floor. Such an arrangement permits short service lines to the equipment on the main floor by drilling through the laminated floor to the network of pipes. Service lines on the lower floor are the conventional type, where rigid conduits drop to the equipment from the overhead network. Lighting represents a large share of the connected electrical load, 4500 kva.

Steam Supply. Four boilers generate a total of up to 63,000 lb per hr of



2 Two of three zeolite water softeners handle up to 1000 gal per min of city water for both boiler and plant service



3 Steam generation comes from three 20,000-lb-per-hr oil-fired units; a firetube boiler burns combustible waste

Power Services to Best Advantage

steam at 60 psi for plant and office process and heating. Three of these units are oil-fired watertube units. The fourth, of firetube design, serves as an incinerator. It burns all combustible plant refuse supplemented, if necessary, by fuel oil.

The fuel supply has had considerable attention. There are three 20,000-gal steam-heated underground oil-storage tanks. From this storage reservoir one of two pumps pull oil through two fuel-oil heaters, which raise oil temperature to the required 180 F before admission to the furnace.

As a precaution against operating interruptions one fuel-oil pump and one preheater are steam operated, while the other pump and preheater are electrically operated.

Steam leaves the boilers at 60 psi and enters the distribution header at this pressure for plant and office needs. Condensate return runs about 80% and reenters the boiler cycle at the 67,000-lb-per-hr deaerating heater.

Water Treatment. The deaerating tank also receives makeup water from two of three 225,000-gal-per-hr zeolite water softeners, Fig. 2. These softeners handle up to 1000 gal a minute of city water—not all of it for boiler use, however. They reduce this water from an initial hardness of 180 ppm as calcium carbonate to near zero. Solid content is also dropped to 8 ppm from an inlet reading of 240 ppm. Whatever traces of oxygen and dissolved gases remain in the water, after the deaerating action, are removed by addition of sodium sulphite at this level. Further water treatment is carried out at the boiler drum by means of chemical proportioning pumps that feed phosphate and caustic to the drum.

Water Softening. The water-softening system is fully automatic. The usual zeolite-softening cycle is applied wherein the nonhardening sodium salts replace the objectionable calcium and magnesium ones.

Five pneumatic valves control flow. A 5-position pilot valve operates the pneumatic control valves. One shuts off the entire softening system. A second permits softened-water flow to the manufacturing building (piped at about 45 psi). The third causes 250 gpm of city water to be pumped through the zeolite and wash away objectionable solids. The fourth brings in brine for regeneration, and the fifth washes away brine not used in regeneration.

After 200,000 gal of city water have been softened in a given tank the chemical reagents must be regenerated. Brine from a 250-gal storage tank enters the softener through a control valve above to accomplish this regeneration. The brine is exchanged for calcium and magnesium in solution with the zeolite. Once released, they are drained off to a storm sewer for final disposition.

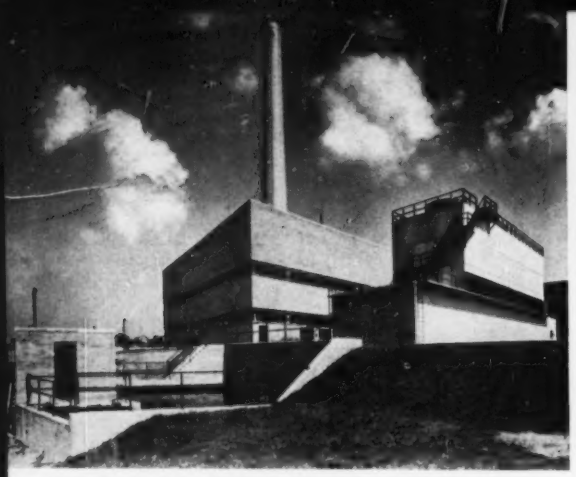
An electrode regulates the level in the 250-gal brine-storage tank. Once this electrode becomes uncovered a relay starts up pumps, which pull from a brine pit, 12 ft deep by 20 ft long by 16 ft wide.

This pit, divided into two sections with a combined capacity of 126 tons of salt, is loaded directly from covered hopper cars delivered by rail and dumped into the concrete brine pit directly under the tracks. Each pit section contains about four feet of water, which dissolves the incoming salt to form a brine solution. Float boxes control the level of the brine in the pit.

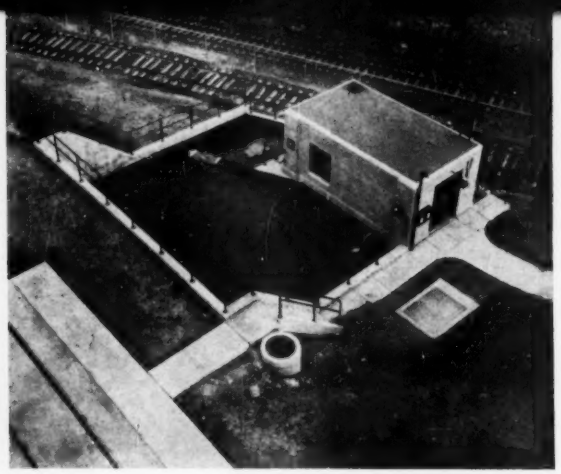
Piping Layout. Softened city water and steam mains form only a part of the total piping connecting the utility building with the manufacturing plant. In fact, there are a total of twelve services which are divided into two groups (1) steam and water (2) process gases.

The first group includes house water, cold city water, steam, condensate return, cold soft water and hot soft water. Second group consists of low-pressure air, high-pressure air, city gas, hydrogen, nitrogen and oxygen. Line pressure for all gases runs 10 psi, except high-pressure air, 100 psi; city gas 7 psi.

Piping layout follows the general scheme used for electrical distribution. All piping lies below the ceiling of the



4 Left, substation; center, utilities building (steam, air conditioning); right, cooling tower; fore, waste disposal



5 Waste-disposal plant has acid-settling and diffusion basin for neutralizing acids; reaction basin for final treatment

ground floor—just below the floor level of the main manufacturing area. Some piping runs crosswise to the remainder in a somewhat plaid-like arrangement to divide the manufacturing floor into successively smaller areas made up of smaller and smaller pipe.

This uniform pattern, together with a standardized selection of piping parts, permits easy and ready connection. It is possible to bring piping through the main floor at any point and yet not be more than ten feet away from a complete set of services. Each pipe carrying a service bears its own identifying color.

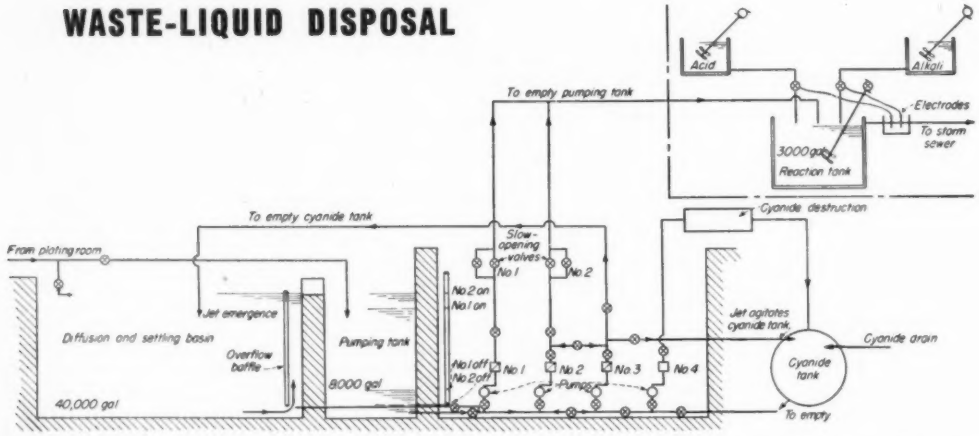
Waste Disposal. The waste products and refuse, which go hand in hand with large-scale manufacturing, receive special attention. Sweepings, scrap paper, cartons and combustible refuse are burned as mentioned above in a firetube incinerator-type boiler that can develop as much as 3000 lb per hr of steam.

Most important in point of quantity, and usually most difficult industrial waste to handle, is that usually dumped as liquid. Principal components of Western Electric liquid wastes are cyanides and acids from the chemical and plating areas.

These two waste products are treated separately, Fig. 5, 6. During the plant's 2-shift operation, cyanide wastes collect in a 3000-gal steel tank where they mix with caustic soda under a close acidity-control system.

After the second shift when manufacturing shuts down, accumulated cyanide wastes undergo a chlorination treatment. This chlorination continues until test samples of the waste show free chlorine. Once this point is reached, the 3000-gal tank is emptied into a 50,000-gal tile-lined diffusion and settling basin where all liquid wastes accumulate before final treatment.

Into this diffusion basin comes raw acid waste, drained from the chemical areas throughout the manufacturing building. This waste settles out in the basin and lies there for 24 hr. Incoming acid, which has a pH of about 4.5, experiences a partial neutralization when it contacts the caustic soda in the



6 Principal liquid wastes are cyanides and acids from manufacturing processes. Cyanide goes to 3000-gal steel tank for caustic soda and neutralization followed by chlorination. Raw acid goes to settling and diffusion basin for treatment

treated cyanide wastes to raise its pH.

Liquid in the settling and diffusion basin spills out over a shallow V-shaped overflow wall into another tile-lined tank, and 8000-gal neutralization basin. Here, the already weak waste acids become completely neutralized by measured additions of caustic soda. An acidity recorder measures and records the degree of acidity and then operates a regulating device to open a motorized valve through which flows a controlled quantity of caustic. Two motorized agitators keep the basin contents swirling to assure thorough mixing of the reagents.

When the acids are fully neutralized, the pH recorder allows float controls to start up two pumps, which discharge the harmless wastes to the Lehigh.

Caustic soda for this waste-disposal plant starts from a 15,000-gal underground tank, filled directly from tank cars. This 15,000-gal reservoir supplies caustic to a 150-gal tank, where it undergoes dilution with four parts of water to each one of caustic. After dilution, the weakened caustic solution can be poured into the neutralizing basin.

Gas Generation. Large quantities of hydrogen, oxygen and nitrogen gases are used in various of the manufacturing processes requiring high degrees of heat. To meet this demand a separate gas generating plant has been built. It uses as raw materials water for producing oxygen and hydrogen and air for oxygen and nitrogen.

Electrolysis reduces water to its two elements. An electric current (1200 amp dc at 200 v) passes through a solution of distilled water and caustic soda by means of a negative and positive pole. Bubbles of oxygen form around positive pole and hydrogen around negative. These gases are led off for treatment.

Air goes through different processes before it is reduced to oxygen and nitrogen. Those processes are liquifaction and rectification.

Future Article. In an early issue the air-conditioning features of this plant will be presented in detail.

PRINCIPAL NEW POWER-SERVICE EQUIPMENT

Western Electric Co, Electronics Plant, Allentown, Pa.

STEAM GENERATION AND AUXILIARIES:

Boilers, 3, 20,000 lb per hr, watertube, oil fired, 160 psi design	Babcock & Wilcox
Boiler, 1, 3000 lb per hr, firetube, incinerator with oil supplement	Union Iron Works
Burners, oil, 7	Peabody Engrg Co
Mechanical: 2, each watertube boiler; 1, each firetube boiler	
Preheaters, oil, 2 { one steam-heated; one electrically heated	Peabody Engrg Co E L Wiegand Co
Tanks, oil, 5	Crown Tank Co
Storage, underground, steam-heated, 20,000-gal	
Valves, blowoff { double tightening and seatless; watertube boilers	Yarnall-Waring Co Babcock & Wilcox Co
Valves, safety { 3, each watertube; 2, firetube boiler	Consolidated Safety Valve Co
Valves, safety, 1, feedwater supply line	J E Lonergan Co
Soot blowers, 3 each watertube boiler	Diamond Power Spec Corp
Valves, miscellaneous	Walworth Co
Pipe covering	The Insulation Co
Instruments, boiler room, panelboard	Hays Corp
Unit heaters, power-plant space heating	McQuay, Inc
Unit heaters, switches	Allen-Bradley Co
Unit heaters, thermostats	Minneapolis Honeywell Regulator Co

PUMPS AND ACCESSORIES:

Feedwater, 3, steam driven	Wagner Steam Pump Co
Traps, 4, feedwater pump	Kay & MacDonald
Regulators, feedwater	Northern Equip Co
Governor, feedwater	Fisher Governor Co
Fire pump, 1 { 1000 gal per min, 278-ft head; Electric-motor drive, 100 hp	Peerless Pump Co General Electric Co
Fuel oil, 1 { Electric driven, centrifugal; Motor drive	DeLaval Steam Turbine Co Westinghouse Electric Corp
Valves reducing, miscellaneous	Atlas Valve Co Spence Engrg Co A W Cash Co
Lubricator, steam, 1, fuel-oil pump	Hills-McCanna Co
Traps	Sarco Co
Condensate, 2 { centrifugal, single stage; electric motor drive	Weinman Electric Co Master Electric Co
Condensate pump starters, 2, magnetic, 45 amp	Trumbull Co
Condensate, 2 { duplex and receiver; motor drive	Skidmore Corp Brown & Brockmeyer Co
Condensate pump starters, 2, ac, automatic	Cutler Hammer Inc
Pump, treated water, 2 { Centrifugal motor driven; Motor drive	Chicago Pump Co Crocker Wheeler Electric Mfg Co
Switches, float	Square D Co
Sump pump, 1 { Centrifugal, 120 gpm, 30-ft head; Motor drive, 1750 rpm	Deming Mueller Co Peerless Elec Co

WATER AND WATER TREATMENT:

Softeners, 3	Illinois Water Treatment Co
Heater, deaerating, 1, direct contact	Hoppes Mfg Co
Chemical water treatment	W H & L D Betz
Meters and valves	Neptune Meter Mfg Co

WASTE DISPOSAL:

Chlorine header, valves, fittings	Wallace & Tiernan Co
Settling and diffusion basin, 48,000 gal	Austin Co
Reaction basin, 8000 gal	Austin Co
Control, pH, reaction-basin outlet	Leeds & Northrup Co
Control, level, reaction basin	Photoswitch Co
Tank gage, caustic soda, 15,000-gal tank	Liquidometer Corp
Motorized valves, 2, caustic-soda system	Conoflow Corp
Controls, motorized valves, caustic soda	Leeds & Northrup Co
Agitators, 2 { reaction basin, motor driven; motor drive	Alsop Engrg Co Master Electric Co
Pumps	Ingersoll-Rand Co
Caustic soda, 20-ft head; chlorinal and acid; acid	
Pump, brine	Electro Pump Co
Valves, reducing	Julian D'Este Div, Reading, Pratt and Cady
Piping, soap	Crane Co
Traps and floats, steam-heating system	Hoffman Specialty Co
Controls, heating system	Minneapolis Honeywell Regulator Co

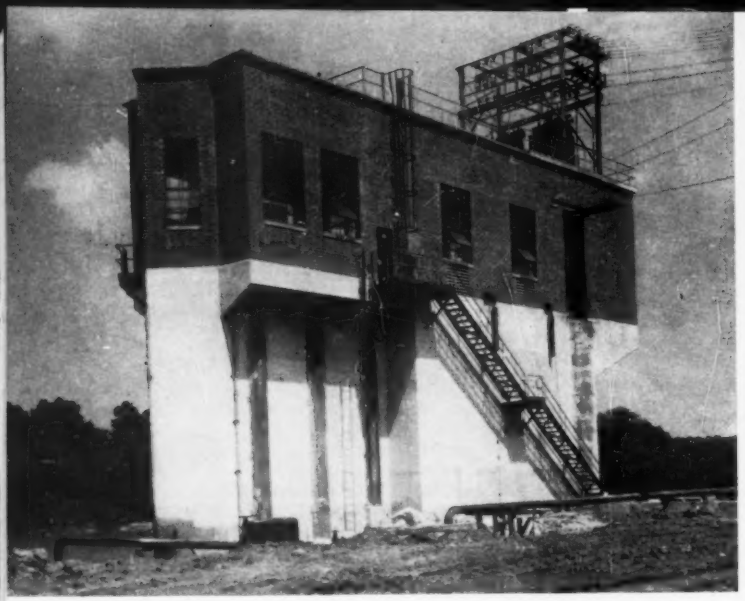
COMPRESSED AIR:

Compressors, 3, 100 psi, 400 rpm, 13x7½x10	Bury Compressor Co
Motors, 3, 100 hp, compressor drive	Westinghouse Electric Corp
Generators, 3, dc, 5 kw, 125 v	Westinghouse Electric Corp
Separators, water, 3, 150 psi, max pressure	R P Adams Co, Inc
Traps, air, 3	H O Trerice Co
Receiver, air, 1	Bury Compressor Co
Aftercoolers, 4, three bin, one, 10-in. dia	Bury Compressor Co
Filters, air	Air Maxe Corp
Relief valves { 6, 40 psi, low side; 3, 110 psi, high side; 2, Air-receiver tank, 110 psi	J E Lonergan Co Consolidated Safety Valve Co J E Lonergan Co

AIR CONDITIONING:

Compressors, 3, 770 ton, Freon, refrigerating	York Corp
Motor and gear box, 3, 800 hp	Westinghouse Electric Corp
Controller, temperature	Minneapolis Honeywell Regulator Co
Pumps, 3 { circ water tower, 2310 gpm, 100-ft head; Motor drive	Ingersoll-Rand Co General Electric Co
Cooling tower, 1, redwood	Lilie Hoffman Cooling Towers, Inc
Fans, 3, cooling tower	Lilie Hoffman Cooling Towers, Inc
Gear box, 3, cooling-tower fan drive	Cleveland Worm & Gear Co
Motors, 3, cooling-tower fan drive	Louis Allis Co
Pump, 1 { artesian well; motor drive	Fairbanks, Morse & Co General Electric Co
Pumps, 3, Chilled water, 1240 gpm	Ingersoll-Rand Co
Tanks, 2, well-pump compression	Richmond Engrg Co
Duct work	Lehigh Engrg Co
Diffusers	W B Connor Engrg Corp
Thermostats	Minneapolis Honeywell Regulator Co
Humidistats, miscellaneous controls	Minneapolis Honeywell Regulator Co
Fans, exhausters	American Blower Corp
Insulation, roof foam-glass	Corning Glass Works Co

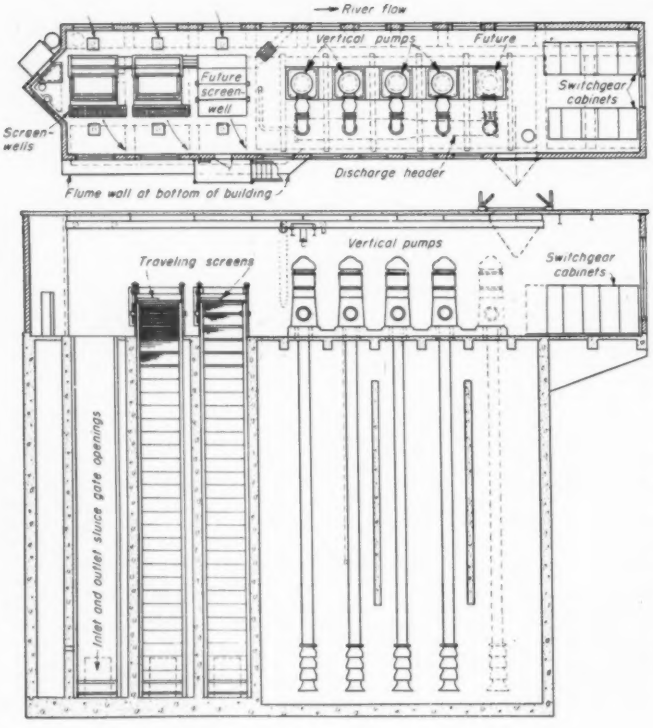
CONSULTING ENGINEERS ..... Austin Co



1 Wet pumphouse, designed for river-level variation of 43.5 ft, has the vertical pump submerged below lowest stage. Transformers on roof help weight house

2 Upstream end of pumphouse shows the narrow building width, "ship's prow"

Design River Pumphouses to

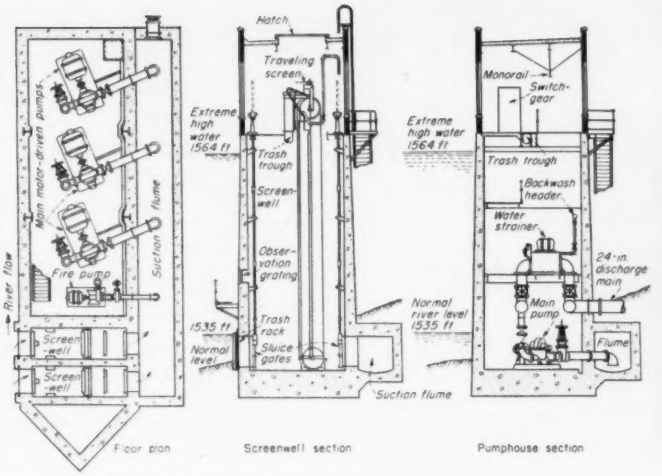


3 Plan and elevation of wet pumphouse above. Flume, 15 ft high, 6 ft wide at bottom of building, connects screenwell outlet ports with pump inlets at right

▶A NEW PLANT is fortunate if it can select a site with an adequate water supply delivered by conduit. But in building plants we often have to provide, also, facilities for drafting water from a stream or larger body of water. Deep wells, not included here, present their own problems and frequently supplement the "river pumphouse" when colder or cleaner water is available at reasonable depths. Some chemical processes find it advantageous to drill wells into aquafiers that yield waters having certain desired dissolved solids. There are other methods for abstracting underground water, but we will discuss the supplying of surface water through river pumphouses. Here are descriptions of four successful designs.

Site. Frequently there is little choice in selecting a site. Riparian rights should always be checked; often local permits are required to take water from a stream.

There are obvious advantages in locating a pumphouse upstream from plant effluent outfalls and on the inside



4 Dry pumphouse has horizontal pumps at building bottom with pump suction having positive head at all river stages. Water strainers are located above the pumps

5 This dry pumphouse has two separate screenwells; layout is like Fig. 4

Suit Local Water Conditions

Many industrial plants meet major problem in providing water for process. Here's how one engineer solved this difficulty at different locations by placing pumphouse out in the river

By S B ROBERTS, *Chief Engineer, Celanese Corporation of America*

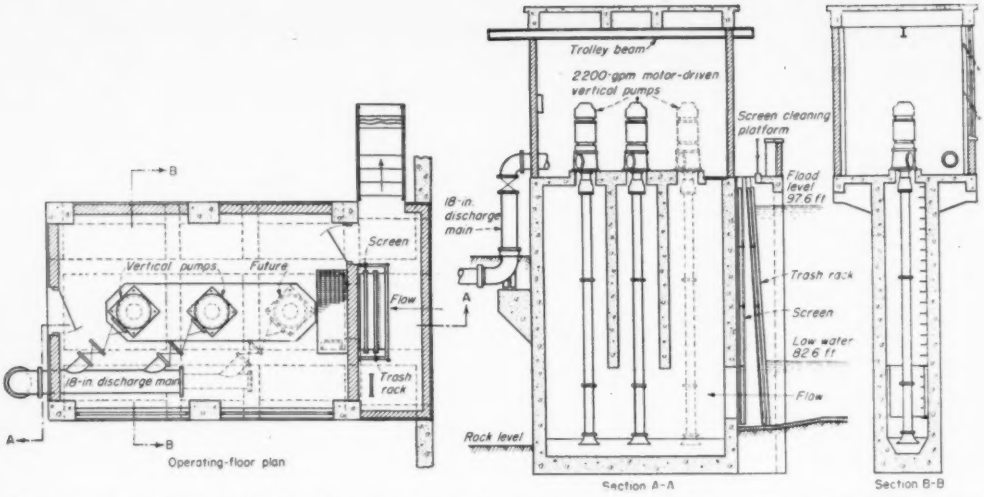
of river bends where less debris reaches it than on the opposite shore. At extremely low water the level in an eddy, dammed by a natural riffle downstream, changes much less than the level in an open channel. With an eddy, however, watch out for recirculation of warm effluent during extreme droughts. Pumphouses in Fig. 1 and 5 are on an eddy, on the inside of a river bend, protected by a fringe of trees on the upstream shore. Fig. 7 shows a small land-bound wet pumphouse where fish and floating hyacinths are the only debris problem.

The pumphouse should be as near the plant as practicable, accessible by truck during normal river stages, and easy to reach with a power line. For designing, river-bed contours are needed as well as careful subsurface study for the foundation. All sites have their own problems, such as avoiding long fire lines and taking advantage of different water pressures in the plant. For example, to have an emergency water supply in the plant the pumping job was done in two steps at the sites served by the pumphouses of Fig. 1 and 8. Water from the river is pumped to the factory site into a reservoir at ground level, and then boosted with pumps of appropriate heads to serve several plant needs. The fire pump at the reservoir drew water from it. This arrangement automatically provided several hours of emergency water supply.

Pumphouse Type. Two general types prove economical to serve small and large industrial plants. Both are hollow-pier houses set in the stream and exposed to floods. In the wet house, pumps are submerged, whereas in the dry house, they are in a deep dry room below water level. For good reasons the many other types have been discarded. They range from a make-shift suction line dropped in the river to the large central power plants handling water quantities that use elaborate equipment.

If we can have the heart of the project, the pumps, in the open instead of submerged "somewhere down in the river" we feel a little surer of their physical condition. Both of these house types have their place. After experience with pumphouses that are located inshore and have open channels or closed conduits leading to them from open water, we have concluded that the safest and most foolproof arrangement puts the house in the river or partly in the stream, unless debris and flood problems are negligible or some very great foundation problem is avoided by moving inland.

Wet Pumphouse. A thorough study of stream records may show such a great range in level that submerged pumps are indicated because the dry house has limitations of height and area to avoid too great a buoyancy force. Fig. 8 shows the simplest pumphouse of this type located on the Middle River in Virginia. It is a simple, exposed, hollow-concrete pier with two vertical 150-gpm 93-ft-head submerged pumps, a trash rack and emergency



6 Wet pumphouse for small plant located on land connected to lake by short canal. Trash rack, stationary screen provide ample protection from fish and floating hyacinths at this location. "Wet" design solves buoyancy problem at flood

port, a small shelter and a trestle walkway from the bank.

Fig. 7 shows an extremely low-cost wet pumphouse for a relatively small plant in Mexico. Variation in lake level is only 15 ft, compared to 31 ft for the dry house in Fig. 5, and 43.5 ft for the wet house in Fig. 1. The site in Fig. 7 provided no rock or other very competent strata on which to build so the house was "floated" with no keys, but it was guided by pouring the end wall of the canal integral with the narrow pump well. All concrete below the operating floor was placed in one pour.

Dry Pumphouse. This type is ideal where its cost can be justified. Fig. 5 shows such a house on the New River in Virginia. It has withstood an extreme flood of 31 ft without service interruption. Fig. 4 gives the general arrangement with the wet end (screen wells) upstream and the flume keyed into the shore. By giving special attention to the floor of the screen pits and flume, the designer met the objective of eliminating cleaning even after a flood.

Pumphouse Design. Minimum floor area of the pumphouse can be determined after selecting screens, sluice gates and pumping units. Knowing building area and height the approximate building cost can be calculated for both wet and dry type of house. This will show the premium cost of a dry house. In the dry pumphouse, Fig. 4 and 5, the lower floor is about 4 ft. 6 in. thick to counterbalance buoyancy; strainers, transformers and all other equipment help to weight the building. Even with a wet pumphouse it is desirable to design a narrow building to reduce the stream force. This produces an uneconomically shaped building according to normal standards, but some additional weighting is needed to resist buoyancy and the force of floods.

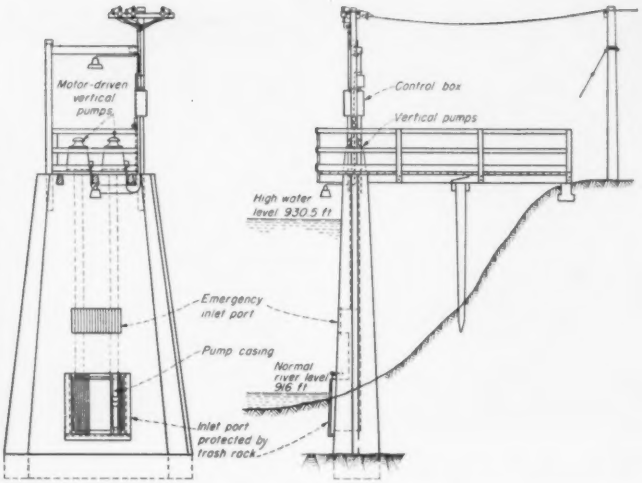
Even a narrow building may need some keying into the rock to prevent sliding, particularly the dry type. Concrete keys and 2-in. steel dowels were needed according to calculation to prevent the dry pumphouse, Fig. 5, from sliding on the bottom should trees and other debris snag across its point. In addition to withstanding exterior pressures during a flood, a dry pumphouse should be reinforced to withstand a building full of water during a drought. Such an accidental and unlikely condition can be caused by a ruptured check valve, pump casing, or other part in the tight pump room.

We think it important that the least buoyant section be the nose or upstream end of the pumphouse. At least one screenwell will be in use during an extreme flood. In a multi-screen house, sluice gates might be closed at one well, and the buoyant effect of the empty wells should be provided for in the design.

With the area and house type determined the foundations may be designed. These must be strong enough to withstand the force of floods, ice, suction at the rear, and a tree snagged on the point. Unequal friction on the two building sides is not a controlling factor. Bridge piers, well-tried structures in resisting these same forces, have been taken as a model for both

7 Land-bound wet pumphouse designed for small plant taking water from lake with 15-ft variation in water level

8 Simple wet pumphouse has two pumps mounted on a hollow concrete pier



9 Wet pumphouse in Fig. 8 has simple trash rack between river and pump inlets. Emergency port allows water flow if trash plugs the main inlet during floods

types of pumphouses as regards shape and foundation practices. A hollow-pier building of this shape has so much mass that it has large factors of safety and is inherently stable with good foundations.

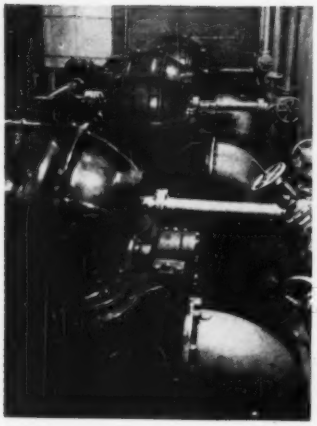
Screening. Although a simple pair of floating logs moored across the intake and followed up by removable fish screens are sufficient for at least two plants where floating hyacinths are the only debris problem, most rivers and lakes require at least trash racks and traveling screens to protect condensers, water jackets and valves. Trash racks give a rough screening of logs, sticks, corn stalks, ice, etc, to protect the traveling screens. They are often set at a slight angle when hand cleaned, and in special cases as much as 60 deg. With long screens it is difficult to justify the cost of concrete apron and guides for angles much off the vertical.

The "screen" surface of the racks is usually made up of $\frac{3}{8}$x2-in. steel bars set $1\frac{1}{2}$ in. apart and welded on edge to suitable stiffener bars behind. This presents an easy "surface" to rake. Conditions at none of the pumphouses described here were severe enough to pay for power rakes. Such rakes are obtainable with milled teeth, discharge troughs, drives, etc. When designing trash racks it is possible to arrange an overhead beam for their removal with a chain fall or power hoist. Racks can be built in short lengths for easy handling with raising hooks. An operating platform with suitable curb can be arranged for cleaning. Fig. 7 shows a bricked-in platform directly above the screen. An open steel platform can be seen in Fig. 5 just above the water. A curb and full-width port in the floor of the platform permits the use of a hand brush or rake. The operator levers the rake handle against the rack while pulling up or pushing down by using the face of the curb as a fulcrum. A favored rake has two 1-in.-dia 10-ft aluminum condenser tubes welded together carrying a "long-bristled" wire brush about 1 foot in length. Racks designed to pass maximum velocities of 2 fps have given no trouble during very bad river conditions. They should be designed for not less than a 2-ft difference in water level from front to rear. Trash-rack-guide slots in the concrete should be designed so planks may some times be inserted in place of the racks to dam off the traveling screenwell for repairs to the sluice gates or for cleaning and inspecting the screenwells.

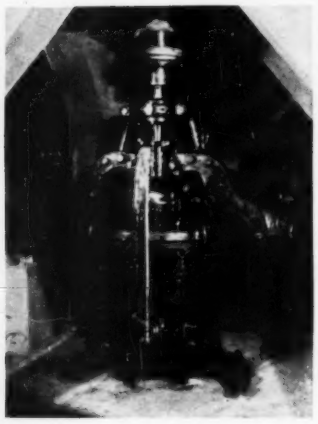
Since they were adapted from sewage works more than 30 years ago, traveling screens have been so improved in design and material, they are now most dependable. They remove leaves, twigs, sticks, etc, are always installed vertically, preferably one per well. A roof hatch allows sliding the whole assembly up the guides to expose the foot shaft, seals, sprockets, chain etc. In rivers of the Middle Atlantic States, $\frac{3}{8}$-in. woven galvanized-wire mesh makes a common and satisfactory screen. Screens are seldom used, but are indispensable to plant operation during dozens of days in fall and spring and after rains.

They don't remove hair from tannery waste nor certain unmentionables from sanitary sewers, which cause much trouble in small process-condenser tubes. Traveling screens must be protected by grilles or trash racks. Manufacturers usually guarantee them for passing water velocities of $2\frac{1}{4}$ fps and to resist a 2-ft head loss. They travel up to 10 fpm. Debris is knocked off the screens into a refuse trough with jets of 60-70-psig water.

The manufacturer's opinion should be sought as to whether sprays are positioned in "front," that is, in back of the ascending screen or placed beyond the head shaft where the screen descends. The writer prefers the "front" position as it permits complete observation of the work performed by the screens and sprays. On one job the wash-water pump handles 450 gpm at 70 psig to serve satisfactorily two 6x56-ft, 9-in. vertical center-to-center screens having a capacity of 20,000 gpm each. Capacities may be safely forecast by calculating the low-water cross section of the screenwell, after deducting 6 in. from the depth to allow for the boot and correcting the area for the wire in the path, then assuming a velocity of $2\frac{1}{4}$ to 4 fps through the



10 Three 5000-gpm water strainers discharge backwash to river from house



11 A 10,000-gpm vertical pump used in dry pumphouse with limited width

screen. A standard $\frac{3}{8}$-in. No. 12-BWG mesh has 60% clear openings. Too slow a velocity through the well may cause silting in sandy streams. With proper initial alignment and a regular inspection to keep the chain from getting too slack, maintenance should be negligible. We haven't been able to justify automatic control of screens because an operator is always in attendance.

Pumps. Capacities of pumping units may be largely dictated by a study of the variations in the plant demand during summer and winter, with multiples selected to provide one spare. Site and factory give little leeway in choosing the head. If a dry pumphouse seems feasible, either vertical or horizontal pumps may be chosen. Both are dependable, but a multistage vertical pump may be considered a little less reliable in certain sizes than a horizontal unit. In the past, 600-hp vertical synchronous-motor-driven units have given more electrical and lubrication troubles than either vertical or horizontal induction motors and horizontal synchronous motors. As dependability comes first in an industrial pumphouse the author favors selecting the pump that best fits the pumphouse and then using an induction motor, unless some very special electrical distribution problem requires power-factor correction at this point on the system. Dependability calls for moderate speeds. Foundations and supports are on the substantial side for vertical units to limit the amplitude of vibration and because some weighting of the house is usually needed in any case.

Piping. Nonshock check valves and rubber expansion joints to each pump are considered essential. Steel pipe is preferred in the headers in the pumphouse and for connections to the plant mains, that is, across the area sometimes flooded. Sheet-steel piling from the cofferdam may be redriven along the buried steel main where it crosses the flats between pumphouse and higher ground to shield the line against erosion.

Strainers. In the dry pumphouse, Fig. 4 and 10, three automatic strainers are installed on the platform above the pumps. They have a capacity of 5000 gpm each in the upstream pump room, and three of 10,000 gpm each in the downstream portion of the house. These strainers take less floor space than horizontal pumps of the same capacity and very slightly more than vertical pumps. Their motors are 5 and $7\frac{1}{2}$ hp for the 5000- and 10,000-gpm units, respectively. The stainless-steel rotor of this particular make is built up with flat- and corrugated-steel ribbons on edge to constitute a strainer with 0.047-in. openings. These are cheaper to operate than sand filters and make a convenient layout when they satisfy plant requirements. One rotor segment is continuously backwashed with 3% of the water. Strainer backwash along with traveling-screen washings are dumped overboard at the downstream end of the pumphouse. Strainers occupy a small fraction of the space needed for filters and don't overload plant sewers. Housing costs are nil because the space they occupy in the dry pumphouse has no other use; also their weight means less concrete to counteract buoyancy.

Other Considerations. Outside stairs are hinged and counterweighted for raising during floods.

When the fire pump is installed in the pumphouse the fire-hose nozzles on the roof provide routine flow testing of fire pump without the use of hoses or any preparation. Nozzles are permanently directed out over the river from a riser through the roof.

Ventilation is required in the two larger pumphouses to carry away heat from the motors (600 hp each).

An overhead line from the factories delivers steam for heating in winter with an emergency connection to the screens. Wet ascending screens have frozen without it. A compressed-air pipe at the bottom of the wells is an aid in case of needle ice. In the dry house, Fig. 5, emergency ports are visible in the screenwells above the trash racks. They provide light, as well as emergency water intakes during extreme floods should the lower intakes be completely choked. This condition has not arisen, however.

A visible and easily read river-level gage is painted on the steel angle on the point of the house. A row boat and long line are in readiness at each pumphouse.

Automatic priming systems are available and have given many years of good service in a large inshore pumphouse where pumps draft from an intake well. Such complications are avoided in all pumphouses shown as the pumps are below low water.

Remote-level gages of the recording type show reservoir or storage tank level to guide operators. Phone, fire-alarm box and toilet are standard.

Only during extreme conditions are more than one man required to attend to everything in the pumphouse.

A cofferdam is usually needed before foundations can be prepared. This temporary construction is generally required for either type of house. In Fig. 1 and 5 the cofferdam cost was less than for flumes across the river flats to a house set above flood stage. Maintaining and cleaning intake conduits is costly on rivers carrying sand and gravel. Furthermore, if the conduits are properly protected at the river by trash racks with working facilities, cofferdams are needed to construct the intake. This arrangement splits the operation of the pumphouse, and usually ends up with poorer protection at the toughest point, the intake.

PREPARING FUEL BED FOR STARTING consists of digging a trench at head of the stoker and spreading thin ribbon of NaPalm gel along length. Torch ignites gel

Incendiary-Bomb Fuel Adapted as Kindling for Stoker-Fired Boilers

By **LEE J LEVERT**, *Division Engineer, Consolidated Edison Company of New York, Inc.*

A wartime weapon used with telling effect on the enemy is harnessed to peacetime use saving time, labor and fuel. Fast starting, easy handling, safe storage, low cost make it ideal ignition fuel when compared with wood kindling

▶ THICKENED FUEL, similar to the mixture used in flame throwers and incendiary bombs, has replaced wood kindling for starting fires in stoker boilers of the Consolidated Edison Co. It saves starting time, fuel and manpower. The thickening agent, NaPalm, mixed with light fuel oil makes a gelatinous, easily handled, inflammable substance.

Starting stoker-fired boilers on the system is important because all its reserve capacity has this type steam generator. Naturally, these older units are less efficient than those carrying the base load, and system economy demands they be brought into operation only when really needed. The quicker these units can be started, the shorter the time they will be in actual operation with resulting saving in fuel consumption.

It takes about 200 lb per hr of coal to dead-bank a boiler with 3000-kw capacity. In addition to the fuel, such a boiler needs constant operator attention, whether steaming or banked. Maintenance needs also increase. It costs about $5 per kw-year to keep a small stoker-fired boiler on the line, hence an annual saving of $15,000 can be realized by avoiding operation of a 3000-kw boiler.

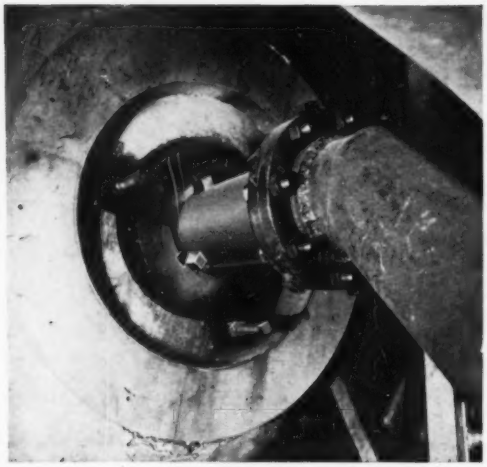
Normal starting time for a battery of small stoker boilers, using wood kindling, was about two hours. A single boiler could be put on the line in less than one hour, if the start were carefully handled. A battery needed a large number of operators during starting, far more than during normal operation. Wood had to be piled on top of the fuel bed, then sprayed with kerosene and ignited with a torch. This method had disadvantages in requiring great care in turning on the draft—lest the fire be put out—and in cutting and storing wood.

Experiments Undertaken. Methods of speeding up starting, to cut banking costs, were studied. Special gas and oil burners for ignition were rejected because of the considerable installation cost and the need for fuel-storage facilities. Experiments with commercial ignition compounds did not show them to be acceptable. During this time the author suggested trying NaPalm. The army had used very effective gasoline-gel-filled incendiary bombs in which NaPalm was the thickening agent. In spite of the name, which connotes sodium, this agent has aluminum palmitate as the base.

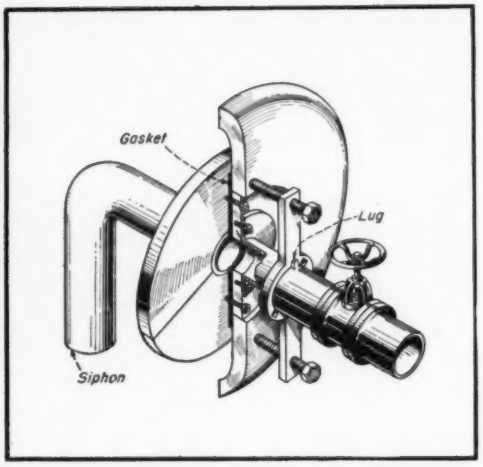
NaPalm gasoline gel, a jelly-like, stringy, tough mixture, has the property of adhering to a surface, even when burning. The thickening agent constitutes about 25% by weight of the mixture and has the same heating value as the solvent. This gel is (1) stable in storage at temperatures from −40 to 255 F (2) not pourable (3) not an explosive. In a bomb an explosive agent must be used to scatter the gel. During the war the Japanese who salvaged some of the NaPalm duds used the gel for cooking and heating.

Using NaPalm. One of the leading oil companies manufacturing NaPalm was

(*Continued on page* 146)



1 Manholes in lower drums make excellent drain points. Use temporary covers fitted with pipe that connect to a sump



2 On these round manholes a split flange holds the siphon end against the outlet piping and seals against drum head

Auxiliary Boiler Drains That

If you clean steam generators and other heat-exchange equipment chemically, or are making plans to do it, here are some valuable aids that will expedite the job and cut outage time

By L E WEST, Dowell Incorporated

▶ ACCEPTANCE OF CHEMICAL CLEANING, for steam generators and related equipment and for various types of process equipment, has led to working out ways and means for reducing outage time to a minimum.

Removing scale chemically has proved to be a safe, fast and economical way to clean boilers, condensers and other heat-exchange equipment in almost all types of plants subjected to fouling by water-borne deposits.

Many plants now incorporate permanent piping when boilers and other equipment are erected as the safest and most economical way to handle the cleaning solvent. Where a plant does not have this piping, temporary lines can be run from the unit to the water, and chemical proportioning equipment used in the cleaning process. Concentration and temperature of the solvent can be controlled at the mobile equipment.

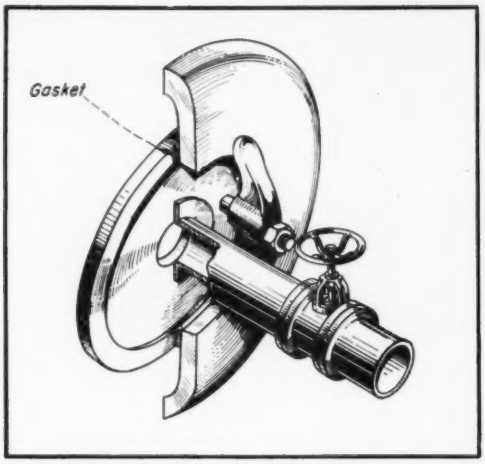
Time a Factor. A large steam generator requires up to 70,000 gal to fill it completely. Often the only existing drain is a single, small blowdown valve, or sometimes two valves, in the lower drum or blowdown header. With such small draining capacity, it takes several hours to empty the generator and this time-element greatly increases the necessary down-time period for the unit.

To cut outage time, a Midwest public utility company has developed a satisfactory method of shortening each drain period on its large steam generators from about 4½ hr to 20 min. That is, about 18 hr were consumed for the four periods of draining the solvent, two clear-water flushes and the final neutralizing solution. The auxiliary drains now reduce the total time to about 1½ hr. So the expense of constructing this equipment is clearly justified, especially since it can be used over and over for subsequent cleanings.

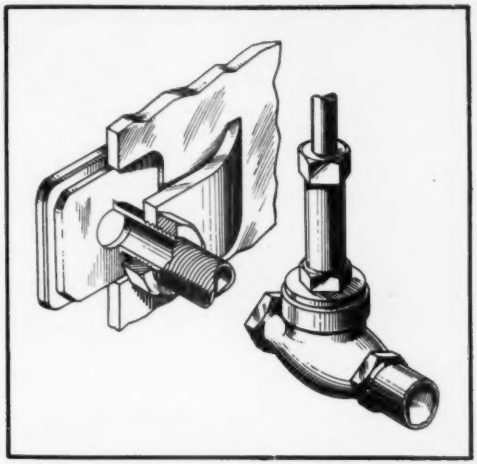
Attachment Design. To solve the problem it was necessary to design an auxiliary manhole cover for the lower drum of a particular boiler, taking into consideration that one of the primary requirements was to siphon out disintegrated materials resulting from chemical cleaning. These settle out in the bottom portion of the lower drum, below the level of the drain itself. This auxiliary cover was constructed to fasten in place by swinging the regular manhole cover back into the boiler in the normal manner, Fig. 1.

The drain problem was solved by cutting a 6-in. hole in the auxiliary cover and welding in a section of pipe. This extended about 18 in. inside the drum where it turned down to act as a siphon, Fig. 2. The pipe also extended outside about 3 feet. It was fitted with a Dresser-sleeve coupling, which enabled the operator to make a secure connection to a drain pipe that had been permanently fitted into a 24-in. down-drain leading to the main blowdown sump. Lugs welded on the pipe extension engaged a strong back which, with its jackscrews, clamped the cover in place, Fig. 1 and 2.

Cost and Saving. Total cost of the drain adapter was about $200, which the utility recovered in savings on the first cleaning job. During one cleaning operation, it saves 16½ hr in outage



3 Temporary drains are easily fitted to the oval manholes because the regular strong backs can hold the plate tight



4 Divided-header boilers can be drained by fitting the pipe to a handhole in the lower part of the connecting header

Speed up Chemical Cleaning

time of the boiler. It effects annual savings as it is used yearly on two identical units in the same power plant.

A new plant uses the same type manhole cover, which can be connected when desired to a permanent drain line stubbed from the wall. When not in use, there is only a 4-in. valve extending from the wall on the boiler side, well above head level.

When cleaning the boiler, it is only necessary to make up a short 4-in. nipple from the valve and connect it to the manhole cover with a sleeve coupling. Other similar arrangements, Fig. 3, would speed up the draining and washing of all types of heat-exchange equipment, which in turn would be reflected in a lower cleaning cost.

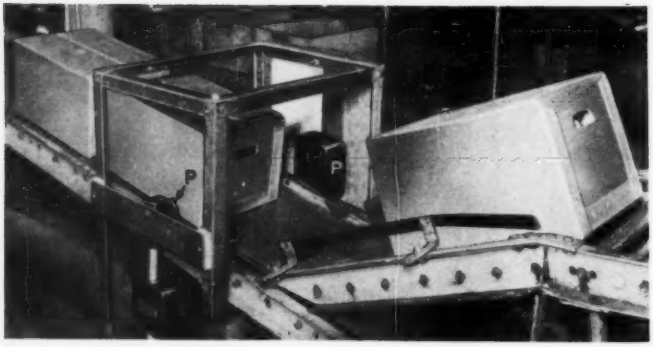
Uses Handhole Plate. On a divided-header boiler—normally drained through a blowdown on the outside of each divided header because there was no mud drum with a manhole as such—it was necessary to use one of the handholes at the opposite end of the header from the normal blowdown connection. A 2½-in. hole was bored in an old handhole cap, to which was welded a piece of 2½-in. pipe, Fig. 4. From this fitting a line was run to the blowdown sump. Normal draining time of this boiler was about 2 hr. By applying air pressure through a vent on the steam drum, it was possible to drain the boiler in 16 min, a saving of one hour and 44 min on each of four drain periods during one chemical cleaning.

Cleaning Surge. Another factor of great importance, and a decided advantage in cleaning sectional-header boilers, is that draining the boiler faster makes it possible to get a "surge" of fluid through the relatively level tubes. This method enables the solvent, rinse water and neutralizing flush to carry out practically all undissolved and disintegrated material. Therefore it eliminates any necessity of removing the handhole caps and flushing each tube separately.

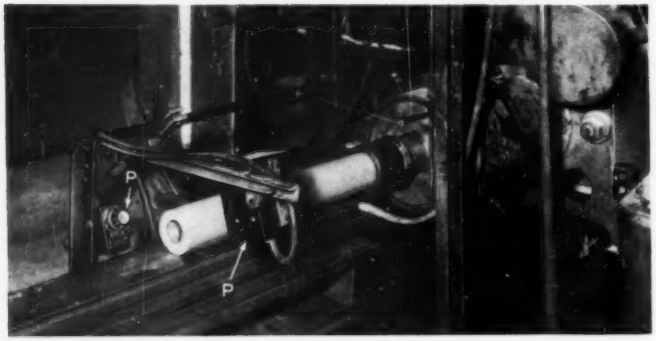
Heat Exchangers. Most surface condensers are designed so they do not present as great a problem as boilers do, in flushing time necessary to place them back on the line. As the volume of solvent needed to clean the steam side is about twice that of the water side, the quick-drain problem is somewhat lessened because the generally accepted procedure is to clean the steam side first. Then the solvent necessary to clean the water side is pumped from the steam side, using whatever amount is needed to remove the deposit (predetermined by examination).

While the solvent is reacting with the water-side deposits, solvent remaining in the steam side can be drained and that side flushed. After the water-side deposit is removed the pumps are started and all solvent is flushed out by the circulating water. Only when the steam side alone is cleaned does draining time have any great effect on outage time. And in most instances the unit can be drained fairly rapidly with existing outlets.

Future Design. New units that are to be cleaned chemically should incorporate several minor changes to facilitate cleaning operations. On boilers, for example, larger blowdown openings are desirable. Also, outlets for removing solvent samples can be built into the boilers at strategic locations. Condensers and stage heaters should have adequate inlet and outlet connections, preferably 2 in. in diameter. Piping should be arranged so individual units can be readily isolated from the rest of the system. Consideration should probably be given the venting arrangements on condensers because deposits in them are often composed mainly of calcium carbonate which, in reaction with acid, produces large volumes of carbon dioxide. Assurance could then be had that no solvent fumes resulting from the chemical reaction would be carried into the turbine during cleaning operation.



1 Photoelectric equipment P counts cases of bottles passing on a conveyor belt. Here the relay actuates a magnetic counter that totals objects as they pass



2 Photoelectric equipment P is used to cut clay tubes to length in a porcelain pug mill. Extruded tube intercepts the light beam to cause cutter to operate

What You Can Do With Photoelectric Relays And How to Do It

Photo-relay characteristics that are essential in applications where they do a better job than other means or where only they improve performance, decrease cost and maintenance, promote safety

By **ERNEST JELLINEK**
Electronic & Regulator-Control Engrg Division, General Electric Company

▶ A PHOTOELECTRIC RELAY is one of the earliest electronic-control devices to be widely accepted by industry. Actuated by a light beam, it serves as a light-operated switch to open or close electrical circuits. Because the light beam cannot be bent, fatigued or burned, its life is affected neither by weight, temperature and other physical conditions of the actuating object, nor by the number of operations. In addition, the light beam cannot damage or retard fragile, polished or painted objects. Besides offering these advantages over a mechanical-limit switch, the photoelectric relay does many jobs that can be done in no other way.

Three Steps. Such a relay contains electronic tubes in a simple circuit, designed to control large amounts of power from the minute energy of a light beam. This control is done in three steps by a phototube, amplifier and magnetic relay.

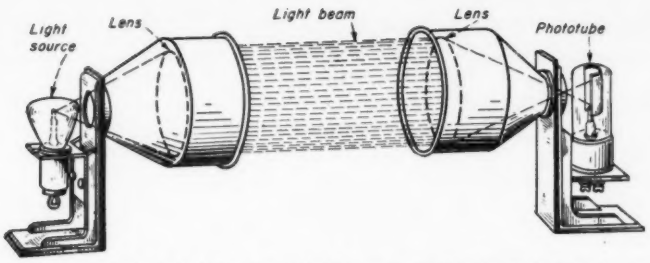
The phototube is an electronic one, which converts light energy into a small electric current of only a few microamperes. The tube contains a semicylindrical cathode whose inside surface is sensitive to light, and it is on this surface that the actuating light beam must be directed.

The minute current from the phototube is then amplified by one or two stages of electronic tubes so sufficient current is available to control the power-switching element. This element generally consists of a magnetic relay, but sometimes may be a thyratron tube capable of directly operating a load such as a solenoid.

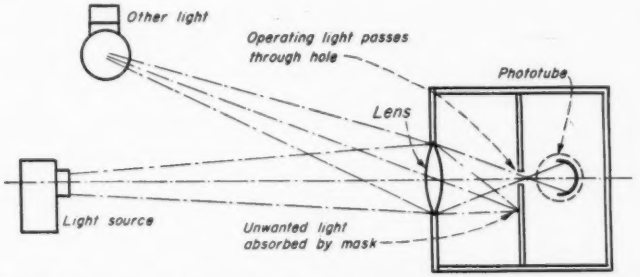
In general, the light beam is provided by an automobile headlight lamp in an enclosure, with a lens for focusing the beam on the distant phototube, Fig. 3. Any object that causes the amount of light on the phototube to either increase or decrease may be made to operate the relay, within certain limits. This change may be produced by interruption, refraction, diffusion or deflection of the beam.

Passage of the light beam directly to the phototube is called transmitted light operation. Often it is desirable to reflect the light beam from the object to the phototube so reflected light operation is used. Still other applications dispense with the light source and operate the relay from light produced by the object itself.

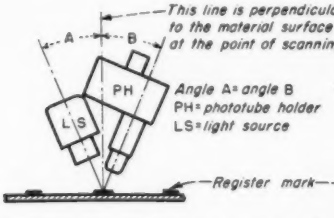
Although many photoelectric equipments do specialized jobs, there is available a line of general-purpose relays that can be used for a variety of applications. These relays are made in large quantities, stocked for over-the-counter sales to customers who find them easy to select, apply and install. Thus, users of even a single unit receive the ad-



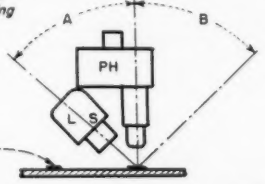
3 In general, the light beam is provided by an automobile headlight lamp in an enclosure. There is a lens for focusing the beam on the distant phototube



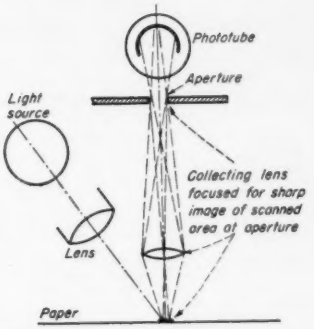
4 Method used to keep unwanted light from the photoelectric tube. Only light projected along the axis of the lens passes through a small hole to the plate



5 In specular scanning, tube receives direct reflection from light source



6 In diffused-light scanning phototube doesn't get light direct from source



7 Lens system to scan definite area on paper surface for large light change

vantage of mass production in lower prices and quicker delivery. When applying photoelectric relays try to adapt a standard relay to the job. In general, there is a standard one which has the desired characteristics, or to which certain accessories can be added, to permit its use for special requirements.

Applications. The table gives typical applications of general-purpose photoelectric relays and lists the four operations they may perform:

1. *Counting.* Here the relay actuates a magnetic counter, which may merely total passing objects, or actuate another process after a predetermined number have passed. For instance, it fills crates with a predetermined number of bottles, after which the case moves on and an empty one takes its place. Fig. 1 shows photoelectric equipment installed to count cases passing on a conveyor.

2. *Inspecting and sorting.* Objects may be inspected and sorted according to certain characteristics on a "go, no-go" basis, such as rejection of containers lacking labels.

3. *Measuring and controlling.* Certain quantities may be measured and controlled on a "start-stop" basis in such a way that a process continues until a preset condition occurs, then stops. This happens in an automatic weighing machine, where material to be weighed continues to pour onto the scale until its pointer intercepts the light beam. Fig. 2 shows a photoelectric relay used to cut clay tubes to length in a porcelain pug mill. The extruded tube comes from the machine until its end intercepts the light beam, which causes the cutter to operate.

4. *Protecting.* Photoelectric relays can cover an area and detect the presence of unsafe conditions. They can protect a punch-press operator by preventing the press from closing until his hands are out of the danger zone. They are also used to prevent accidents on one-way bridges or in one-way tunnels.

In each of these processes, light may be directed to the phototube by any of three ways: (1) transmitted (2) reflected from the object (3) obtained directly from it.

Transmitted-light operation is the easiest to visualize, as the light source and phototube are in a direct line, Fig. 3, and the actuating objects pass between to interrupt a portion of or all the light. It is merely necessary to direct the light beam to obtain maximum effect from passage of the object. This requires that (1) sufficient light from the source is presented to operate the relay and (2) light received by the phototube is changed enough when the object passes. It is also important that light from other sources be kept from the phototube because it would decrease the percentage light change caused by the object.

Fig. 4 shows a method to direct the light source on the phototube and to prevent the influence of outside light. A lens is so placed that its focal point occurs in a small hole in a plate in front of the phototube. Only light projected along the axis of the lens passes through the hole to the tube. Light from other angles is focused on the plate, and thus rejected.

The light source, therefore, must be focused on the receiving lens and the whole system placed in the proper position to be affected by the object. If

TYPICAL APPLICATIONS OF GENERAL-PURPOSE PHOTOELECTRIC RELAYS

Process	Light from: Transmitted beam	Reflected beam	Object
Counting—	Opaque parts, vehicles, people	Shiny parts, mirrors, lenses, metal parts	Hot parts from heat-treating oven, ingots
Inspecting and sorting (go, no-go only)—	Height, width, holes, bottle contents, flaws in glass	Labeled cans, plated parts, flaws; sorting packages according to coded location of marks	Lamps, fluorescent material, hot parts
Measuring and controlling (start-stop only)—	Length, bottle contents, metered quantity like weight or current	Length of web according to printed marks	Incandescence of heated body, illumination level
Protecting—	Machine operator from accidents. Against burglary, traffic hazards	Same as under transmitted beam, using mirrors for better area coverage	Flame failure in oil or gas furnace

boxes passing along a conveyor are to be sorted according to height, the light source and phototube are mounted on opposite sides of the conveyor. The light source is so placed that its beam is horizontal and at the level where its low edge is slightly below the maximum permissible box height. Any box over this height interrupts part or all of the beam, and causes a relay to operate that diverts or marks the box.

This system can sort into only two groups, boxes below and above a certain size. Further division could be obtained by additional units at other heights.

Smoke Detection. Transmitted-light operation is also used for smoke detection in air-conditioning ducts, excess-smoke alarms for stacks, and combustion control. In each case, the light beam is passed through the stack or duct so any smoke reduces the amount of light received by the phototube. In air ducts, it is necessary to operate on a small decrease of light to sound an alarm and shut off the system at the first sign of fire.

When operating on light reflected by an object, the light source and phototube holder are in a position where they receive the most effective light change. In detecting objects more than a few inches from the phototube, *specular reflection* is used. This means that the phototube is placed at an angle from the object equal and opposite to that of the light beam, Fig. 5, so mirror reflection of the beam is directed to the photo tube.

This type of scanning is suitable for detecting cans that lack labels. All cans pass by the scanner in single file and for each reflection received by the phototube, a gate diverts the unlabeled can. Cans with labels do not reflect enough light to operate the relay.

Another more important use of reflected-light scanning is for processes using printed marks on continuous webs like paper. Wrapping, bagmaking, and labeling machines use a paper roll on which individual wrappers, bags or labels have been continuously printed. Each must be cut with a definite relationship to the printing as, for example, with the trade name centered. This is done by photoelectrically scanning a register mark, printed during the original run. This mark is usually a line one inch long and $\frac{1}{8}$ in. in the direction of motion. Located in a clear track at the edge of the paper, it indicates to the phototube the exact position of the printing, regardless of slippage, shrinkage or stretching of the paper.

To operate a photoelectric relay by the passage of this mark, we must have the needed light at the phototube and cause sufficient change of light when the mark goes past. Located only a few inches away from the paper, the light source through its double lens focuses an intense light spot on it. This spot, only about $\frac{1}{4}$ in. in diameter, is so bright the human eye can see no variation when the register mark passes.

Phototube receives the reflected light through an aperture plate that confines the field of view to a small area, thus producing a large percentage of light change when a mark passes. A lens, placed near the web, produces a magnified image on the aperture plate, but only a small part of this passes through the aperture to the phototube, as in Fig. 7. If the aperture is $\frac{1}{8}$x1 in. and the lens magnification is 5, the phototube sees a spot 1/40x$\frac{1}{5}$ in. Thus, as the register mark passes, the phototube's view changes quickly from all white to all black.

The two types of reflection used in web scanning are specular and diffuse. The choice is determined by the best contrast between web and register mark. This contrast varies with the character of web and mark. Specular scanning is obtained, as in Fig. 5, by locating the phototube to receive direct reflection from the light source. This is used for shiny material such as aluminum foil or cellophane, with printed or embossed marks. Care must be taken to prevent scratches or wrinkles in the sheet since they give false signals. Fig. 6 shows an arrangement for diffused-light scanning where the phototube does not receive light directly from the source but only that diffused by either the mark or the material.

An interesting application of photoelectric relays requires no light source but operates on light produced by the object. An example is operation from the light of flame in a furnace, to indicate flame failure. Since certain phototubes are sensitive not only to visible light but to infrared, they may operate by radiation from hot objects. As a rule, an object at 2000 F or higher emits sufficient radiation to operate a standard photoelectric relay.

Cement Lining Keeps Water Tank in Service

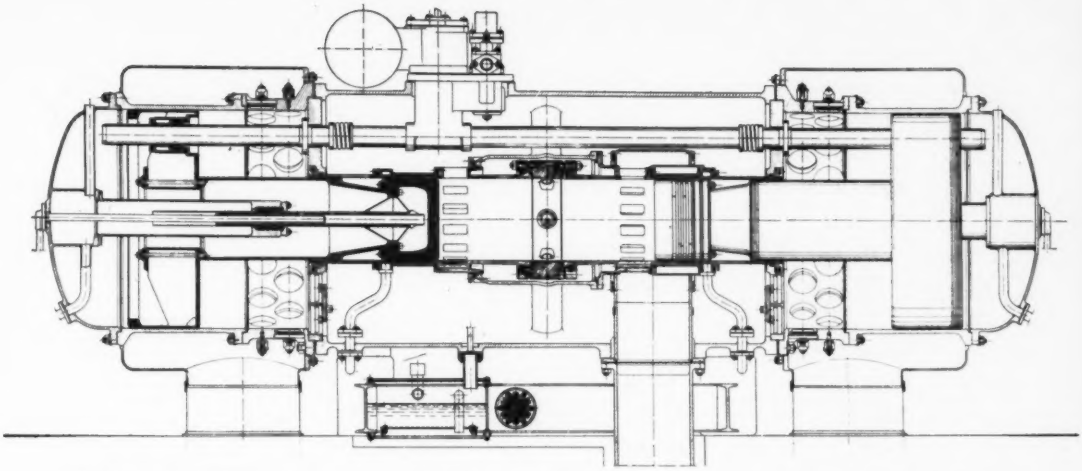
Our domestic water tank had rusted so badly that water from it was objectionable. The tank was made of galvanized steel with copper tubing and pipe connections. It was old and had been brazed in several places where rusted through.

At the time we could not get a new tank so had to do something with the old one. When we examined its inside, we found a thick coat of scale and rust. This we removed, then covered the inside with a mixture of clear Portland cement and water. After drying for a day we put the tank back in service.

At first the water was hard, but after about two weeks it was as soft as before the tank was lined with cement. The tank has now been in service for over two years without return of the rust.

THEODORE F BUMP

Middleboro, Mass.



FREE-PISTON GAS-PRODUCER has an opposed-piston diesel cylinder with single-acting air-compressor cylinders at each end. Compressed air scavenges and supercharges diesel cylinder; exhaust gas goes to turbine, which produces shaft power

French Develop Free-Piston Engines

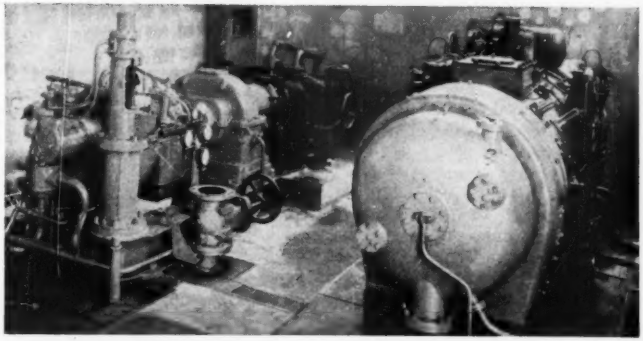
By **PROFESSOR G EICHELBERG**
Federal Institute of Technology
Zurich, Switzerland

Work of Pescara, a pioneer in the field, and his associates, leads to interesting free-piston power-plant designs. Here is a condensed report of the development and some test results*

▶ THE FREE-PISTON POWER PLANT may be considered as a highly supercharged 2-cycle diesel engine with expansion extended to atmospheric pressure in a turbine. Working cycle can be followed clearly in the cross section above. Burning fuel in center of diesel cylinder pushes apart the opposed pistons, each of which is connected to a piston for compressing air in a single-acting cylinder.

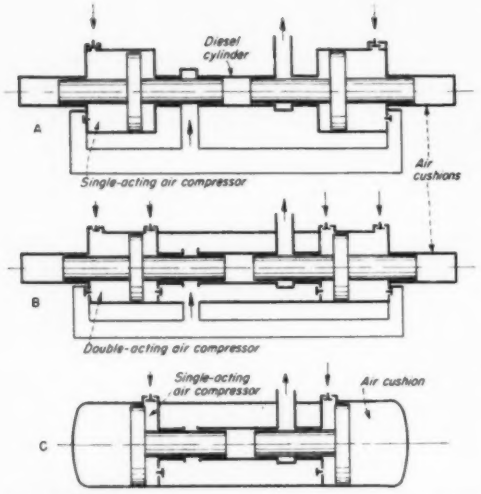
Air enters through valves around the cylinder walls and, after compression, discharges through valves between the air cylinder and the central air space. From this space, compressed air enters the diesel cylinder, through the ports at the left, to scavenge and supercharge it. Diesel exhaust leaves through ports at right.

GAS PRODUCER. Sole output of this gas producer is the exhaust gas, having a pressure of the order of 75 psi and a temperature of about 900-950 F. All useful shaft power of the plant comes from the gas turbine in which exhaust gas is expanded to about atmospheric pressure. The gas producer thus combines, in a single unit, the functions of combustion chamber and compressor of a conventional gas-turbine plant, and also handles part of the expansion. Having the intermittent operation characteristic of reciprocating machines, the gas producer can sustain high maximum temperatures without special alloy materials. This leads to thermal efficiencies of the order of those achieved in diesel

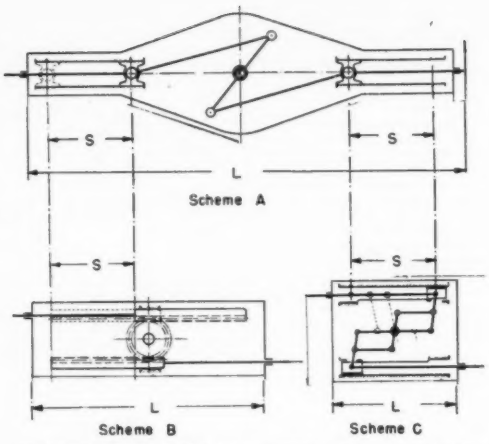


FREE-PISTON PLANT: Turbine, reduction gear and water brake on test bed at the left; gas-producer unit at right is of design shown in the cross section above

* This article is abstracted from a complete report and supporting drawings furnished to POWER by Professor Eichelberg. More complete versions appear in *Schweizerische Bauzeitung* (in German) and *Genie Civil* (in French).



AIR CUSHIONS: Of three possible arrangements, Pescara design employs one at bottom, using full air-piston surface



SYNCHRONIZING RODS: Three possible schemes for holding pistons in step compared as to total length for same strokes

engines, or higher. Design studies indicate that free-piston plants can be made both smaller and lighter than either conventional diesels or gas turbines.

Job of the gas producer could be handled, of course, by a crankshaft unit rather than one of free-piston design. The latter, however, offers a number of real advantages. In addition to simplifying construction, absence of cranks and bearings permits high compression and maximum pressures without the limitations imposed by bearing-load considerations. In free-piston units, stroke and final position of the piston may be adjusted to prevailing conditions, thus keeping compression within reasonable limits in spite of changes in supercharging pressure from zero at starting to, say, 75 psi at full load.

CONTENTS OF REPORT. This report outlines the features of free-piston development carried out in France by R de Pescara, pioneer in this field, and a team of specialists under leadership of R Huber, former assistant to Prof Stodola, of the Swiss Federal Institute of Technology. Design studies were made by the Societe d'Etude Mecaniques et Energetiques and especially by the associated Bureau Technique Pescara, in Paris. Construction was handled in the shops of Societe Als-Thom in Belfort, and Societe Industrielle Generals de Mecanique Appliquee (SIGMA) in Lyons-Venissieux.

A primary consideration in design of a free-piston unit is to secure a balance of work not only between engine and compressor, but separately for each inward and outward stroke so pistons come to rest at end of each. Both conditions can be fulfilled for a given output by selecting correct compressor diameter and providing a suitable compression chamber for storing the return work in the compressor.

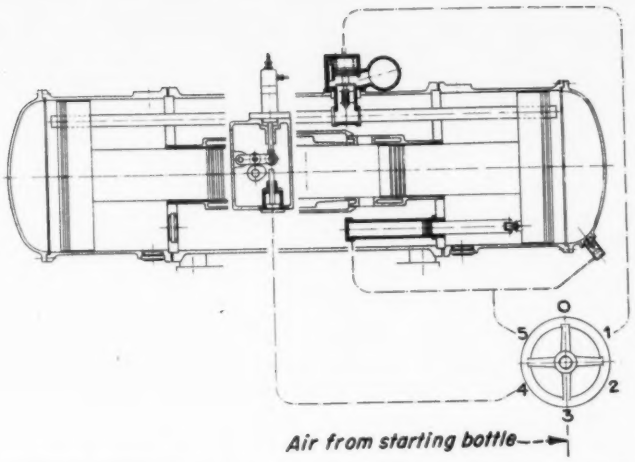
AIR CUSHIONS. As it is, however, desirable to maintain constant or only slightly varying engine compression at different supercharging pressures and stroke lengths, it becomes necessary to introduce an additional air-cushion cylinder where air is alternately compressed and expanded by piston motion. Diagram shows three possible arrangements.

Pescara design employs scheme *C:* a single-acting compressor on inner side of piston, outer surface of piston acting as an air cushion. This permits making the machine shorter and only a low pressure is needed for cushioning because of the large piston area. Main advantage lies in the fact that total compressor work is accumulated during outward stroke, producing a large force acting backward. Thus acceleration of inward motion is high and number of strokes increased. Accessibility of engine pistons is also improved.

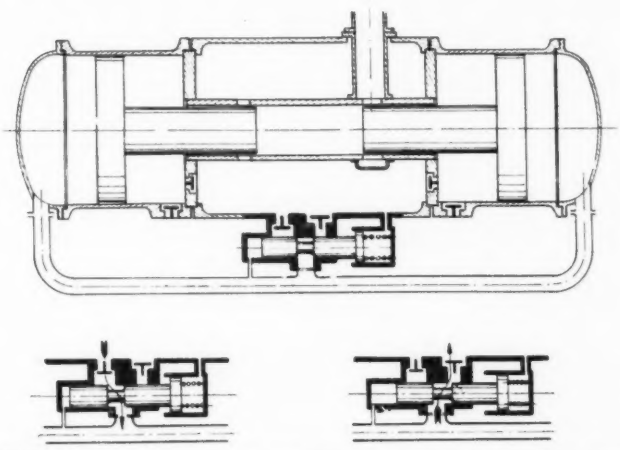
SYNCHRONIZING RODS. Despite the name "free piston," the two sets of pistons are not entirely independent mechanically. Incidental deviations from symmetrical positions must be prevented by suitable rods. These serve to take up only secondary disturbing forces. Gas forces are inherently balanced, only slight differences being due to variations in valve tightness, etc. These differences can be equalized by a bypass between corresponding cylinders, leaving only differences in piston friction to be balanced by the *synchronizing* rods. Of the several schemes of connection diagrammed above, the Pescara design employs *C*, which makes for a short gas-producer construction.

GENERAL CONSTRUCTION. Longitudinal section on preceding page reveals general construction of the gas producer. Supporting center piece is formed by a barrel-shaped casing of welded steel, having the same diameter as compressor cylinders at either end. Air-cushion chambers have dished ends. In the central casing is the watercooled engine cylinder. Remaining annular space being only partly taken up by the chamber for the synchronizing rods, it is sealed to serve as a receiver for the scavenging and supercharging air. Air from compressor cylinders discharges into receiver space through pressure valves in the compressor covers.

Sliding surfaces of engine and compressor cylinders carry the piston weight. A guiding pipe through the entire length of the machine provides an open passage between the two air-cushion chambers, equalizing the air pressure and, at the same time, prevent-



STARTING SYSTEM: Unit is started by introducing air under pressure to cushion chambers. Control insures simultaneous admission of right amount at proper pressure



STABILIZER: Backpressure valves and controlling slide valve coordinate mean pressure in air-cushion spaces with supercharging pressure at various engine loads

ing any rotational movement of the pistons. Arrangement for cooling the engine pistons requires only a single stuffing box at each end. The air-cushion space reaches deep into the interior of the engine piston.

Admitting pressure air to the cushion spaces throws the pistons from their outer position toward inner dead center. Because of the large piston area, air pressure need not be high. Starting system must, however, provide for supplying right amount of air, at proper pressure, to both chambers simultaneously. Starting-system diagram shows the connection from starting apparatus and previously mentioned guiding pipe between the two air-cushion chambers.

STARTING PROCEDURE. Putting the control wheel in first position delivers air at a preselected pressure to a small receiver, air pressure in the receiver holding a disk valve closed. At position 2, air pressure on top of a control plunger integral with the disk valve is released, admitting air from the receiver to the cushion chambers. Bringing control wheel to the third position closes the air-delivery pipe, pressure of air above the plunger closes the disk valve and the small receiver fills again.

At position 4, air pressure lifts the fuel-pump plunger and piston motion dies out. Bringing control wheel to fifth position causes a small air-pressure piston to return pistons to outer dead-center and air is expelled from cushion chambers. After returning control wheel to position 0, starting operation may be repeated. It is possible to start and stop the unit in 20 seconds.

STABILIZER ACTION. An important function still remains: Mean pressure of air-cushion chambers must be adjusted in accordance with prevailing working pressure (supercharging pressure or pressure before the turbine). When working pressure changes, air-cushion mean pressure must be altered in the same proportion, to hold proper compression pressure in the engine cylinder. The *stabilizer* does this automatically.

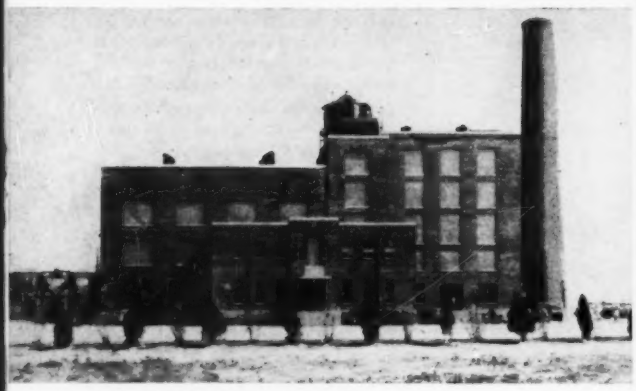
Mean pressure in the air cushions is automatically adjusted to pressure in the engine case, which is a function of engine load. But while pressure in the engine case, that is, of the scavenging air, may be assumed constant for any given load, air in the cushion cylinders is compressed at every stroke and allowed to expand again. Thus it is at times above engine-case pressure, and sometimes below.

Consequently, during one part of the stroke, air may flow from engine case to cushion space, with return flow during the other part of the stroke. For this purpose a passage is provided between the engine case and the pipe connecting the air-cushion chambers. By introducing a backpressure valve and a controlling slide valve, this passage may be kept open until desired pressure balance between engine case and air cushions is maintained. Stabilizer diagram shows this arrangement and position of slide valve during admission and expulsion periods.

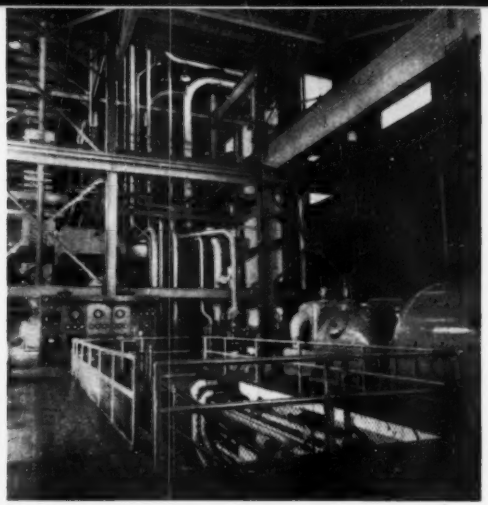
Stabilizer may be built as a single backpressure valve incorporated in a movable slide valve. Most suitable backpressure valve is the type usually employed for compressors, with a cross section of ample dimensions. The valve is operated by a spring-loaded stepped plunger, by which any desired linear regulation of pressure from air-cushion level to engine-case level may be obtained.

FUEL INJECTION. In free-piston engines, fuel-injection must meet special conditions. Fuel must be injected during a period that includes the inner dead-center position of the pistons, when there is no motion. It thus becomes necessary to operate on a system of accumulation. Fuel must be metered

(*Continued on page* 156)



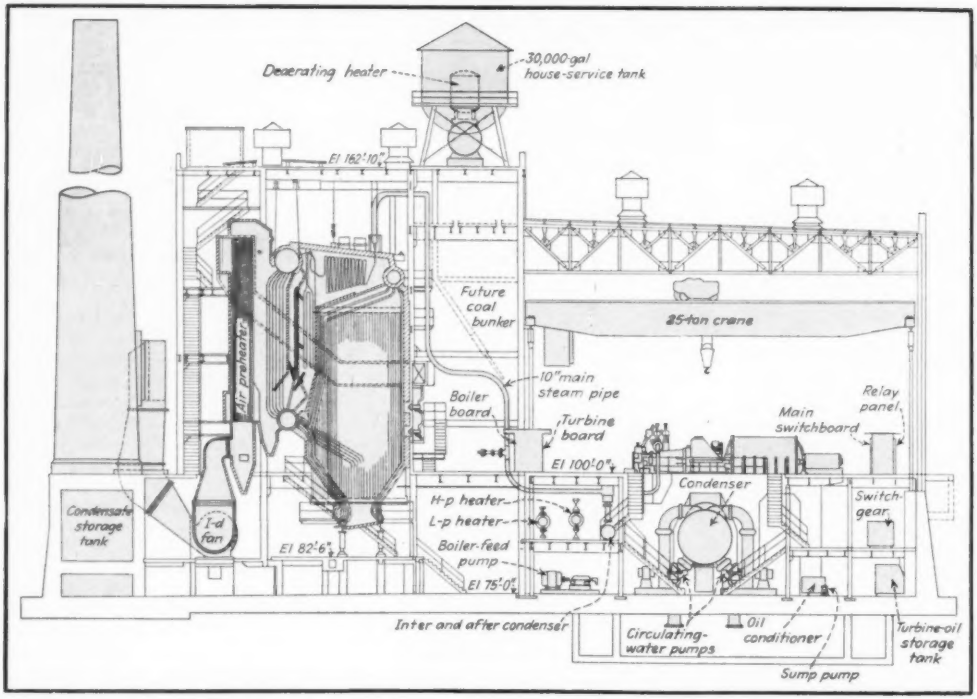
PLANT HAGOOD houses all equipment except deaerating heater and storage tank (on roof). Induced ventilating scheme draws air through first-floor windows and basement areaways, discharging through roof



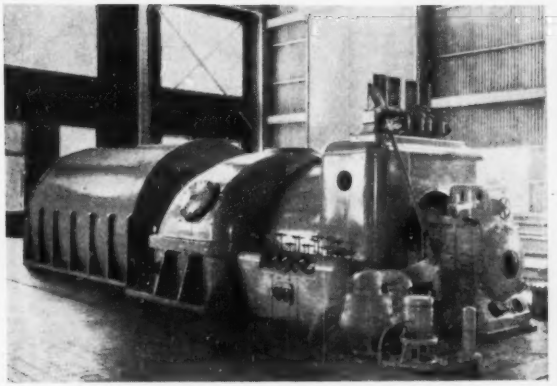
NO WALL separates turbine-generator, right, and oil-fired boiler, center back. Control board of turbine backs onto that of boiler, centralizing supervision.

Plant Hagood Meets Growing

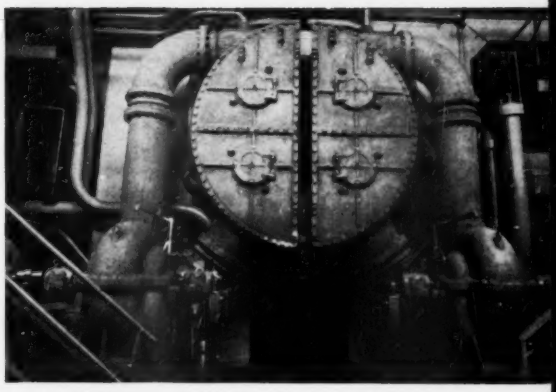
By D H DAVIS, *Superintendent of Production and Transmission, South Carolina Power Co*



CROSS SECTION OF STATION shows simple arrangement of equipment. Oil-fired boiler can be quickly converted to gas. Note ample space provided for possible future coal-handling and firing equipment. Operators need not go above first floor



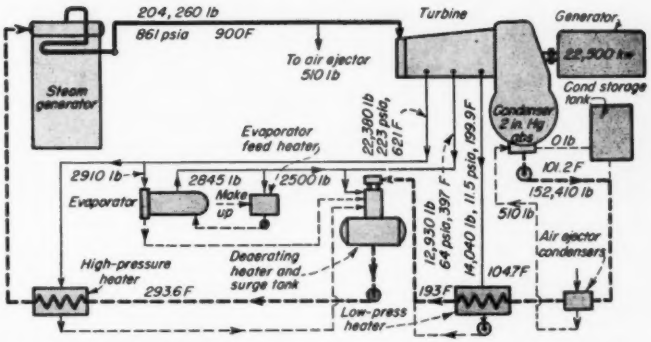
TURBINE-GENERATOR, 22,500 kw, uses 850-psig 900-F throttle steam, exhausts to condenser at 2-in. Hg abs backpress. Three bleed points supply one deaerating and two closed heaters



MAIN CONDENSER with 20,350 sq ft heat-transfer surface arranged in two passes is served by two 13,000-gpm circ-water pumps driven by 100-hp motors; takes water from Ashley River

Charleston's Electrical Demands

Extension of new plant is planned as first unit goes into service. Station will provide major part of energy formerly purchased from the neighboring utility systems through interconnected lines



STATION HEAT BALANCE uses three of four turbine bleed points. Steam generator has air preheater, no economizer. Gas bypass in boiler controls steam temperature

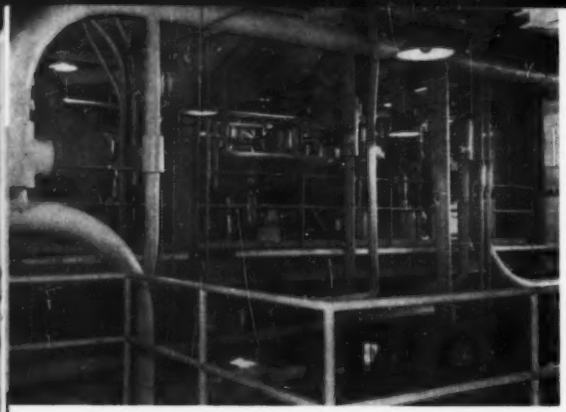
► Before World War II, electric load in the Charleston area was supplied from a 19,000-kw steam plant in the city and by transmission from South Carolina Power Co's hydro plant and neighboring utilities. The area's energy consumption grew from 89,000,000 kwhr in 1940 to 216,000,000 kwhr in 1944. Peak demand grew correspondingly from 21,000 to 46,000 kw.

An additional source of power was needed so a site for the new plant was acquired on the Ashley River, two miles north of the city. At this point there is access to deep-water navigation allowing fuel delivery by tanker or collier; also, there is an adequate supply of condenser cooling water.

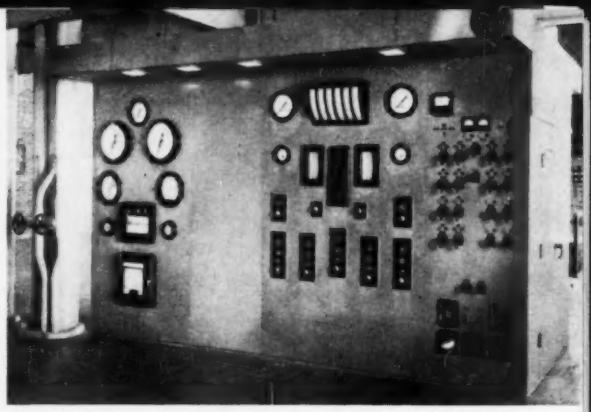
Construction of Plant Hagood began Dec 1, 1945, and its first power was produced on Nov 20, 1947. The plant, named for Benjamin A Hagood, first president of South Carolina Power Co, was dedicated on June 3, 1948. Plans are now being prepared for Unit No. 2. Construction is to begin early in 1949 and operation is scheduled for May 1950.

The station, designed by the engineering group of Commonwealth and Southern Corp, southern division, very closely duplicates several of its other plants in the Southeast. One of them, Plant Eaton, has been described in detail in Power, Nov 1947, pp 90-4. Accordingly, only a brief outline of the highlights of Hagood will be given here, principally where they differ from Eaton.

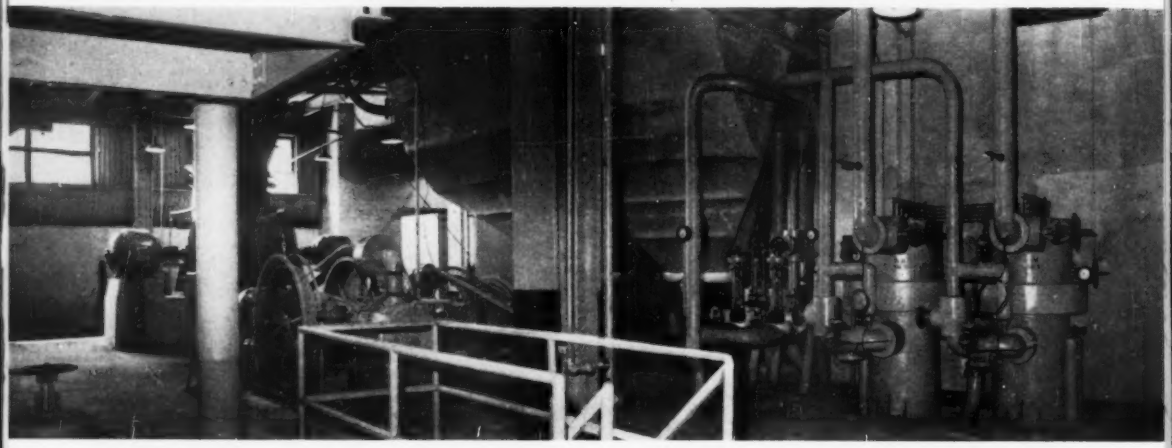
Plant Highlights. Planned to house four units ultimately, the station will operate on the unit system with one boiler feeding one turbine, and the generator connected to the system through one main transformer. First unit comprises one 230,000-lb-per-hr oil-fired boiler, feeding a 22,500-kw turbine at 850 psig and 900 F. Turbine exhausts at 2 in. Hg abs into a 20,350-sq-ft surface condenser. Heat-balance cycle is simple, using only three of the turbine's four bleed points. The end points feed closed high- and low-pressure heaters and the middle point feeds the deaerating heater and single effect evaporator of makeup water. No economizer is in-



HEATER FLOOR ACCOMMODATES the 4-pass low-pressure, 2-pass high-pressure heaters, evaporator and its feed heater



ALL CONTROLS AND INSTRUMENTS of steam generator centered on board facing boiler firing front for easy supervision



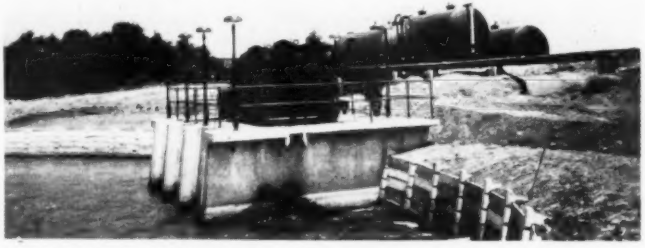
FAN-FLOOR VIEW shows, left to right, forced-draft fan driven by two motors, service- and control-air compressors, flue-gas ducts leading to induced-draft fan and fuel-oil heaters. Apparatus is below operating floor to rear of boiler

cluded in the steam generator although there is a tubular air heater.

Two factors were thoroughly investigated before starting construction: (1) subsurface exploration for foundation conditions (2) effect of river currents on cooling-water availability without causing recirculation.

Subsurface Exploration. Test borings showed sand and clay existed to elevation minus 40. Below that was a level layer of marl, over 200 ft thick. The marl consisted of very loose, fine particles, 76% passing through a 200-mesh sieve. It has a void ratio of 54% and specific gravity of 2.68, giving it a weight of 76.5 lb per cu ft. These data indicated the particles were in loose contact with one another and had not been subjected to much load.

Some settlement was expected, but the question was raised of whether this marl would flow under load the same as clay that was as fine and loose as the marl. Test pilings were driven into the marl and loaded with 12 times the design load to answer this question. No settlement over a week's period was observed, and hence no trouble of this nature is anticipated.



CIRCULATING-WATER INTAKE draws water from Ashley River bottom to assure ample cooling supply. Day tank, condensate drain tank, starting oil tank (in back)

Effect of River Current. Predicting recirculation of condenser cooling water presented a new problem. So far as we knew no plants in this part of the country used tidal water in the quantities Hagood will ultimately require, 25,000 gpm per unit. Plants investigated were either on streams that flow uniformly to the sea or had much cooler

PRINCIPAL POWER-PLANT EQUIPMENT

Plant Hagood, Unit No. 1, north of Charleston, S. C., South Carolina Power Co

TURBINE-GENERATOR:

Turbine-generator ..... General Electric Co
850-psig, 900-F, throttle steam, 2-in. Hg abs exhaust, 4 bleed points, 22,500-kw, 0.9-pf, 13,800-v, 3-phase, 60-cycle, 3600-rpm, 100-kw direct-connected main exciter, 4-kw direct-connected pilot exciter, hydrogen cooled.
Oil filter, 540 gph ..... Bowser, Inc
Condenser ..... C H Wheeler Manufacturing Co
20,350 sq ft surface, two passes, divided waterbox
Circulating pumps, 2 ..... C H Wheeler Manufacturing Co
Single-stage, 13,000-gpm, 430-rpm, 2300-v, 100-hp motor drive
Condensate pumps, 2 ..... C H Wheeler Manufacturing Co
3-stage, 400-gpm, 1150-rpm, double-suction, 575-v, 75-hp motor
Air ejectors, 2-stage ..... C H Wheeler Manufacturing Co
Priming ejectors ..... C H Wheeler Manufacturing Co

STEAM-GENERATING EQUIPMENT:

Boiler ..... Riley Stoker Corp
975-psig design, 875-psig operating, 230,000 lb per hr, 11,700 sq ft convection surface, 7855 sq ft waterwall surface, 13,400 cu ft oil-fired furnace
Superheater ..... Riley Stoker Corp
Convection, inter-bank, 9550 sq ft surface
Air preheater ..... Riley Stoker Corp
Tubular, 31,500 sq ft surface
Forced-draft fan ..... American Blower Corp
77,500 cfm at 1180 rpm, 57,500 cfm at 875 rpm, 2-motor drive—200-hp 2300-v, and 75-hp 2300-v
Induced-draft fan ..... American Blower Corp
140,000 cfm at 705 rpm, 99,000 cfm at 500 rpm, 2-motor drive—450-hp 2300-v, and 150-hp 2300-v
Blowoff valves ..... Yarnall-Waring Co
Water columns, 2 ..... Diamond Power Specialty Corp; Reliance Gauge Column Co
Safety valves ..... Manning, Maxwell & Moore, Inc
Soot blowers ..... Diamond Power Specialty Corp

FUEL-HANDLING AND BURNING EQUIPMENT:

Unloading pumps, 2, 250 gpm against 120 psig ..... Quimby Pump Co
Booster pump, 50 gpm against 120 psi, motor drive ..... Quimby Pump Co
Booster pump ..... Worthington Pump & Machinery Corp
50 gpm against 120 psig, duplex reciprocating steam drive
Starting pump, 15 gpm against 300 psig, motor dr ..... Quimby Pump Co
Burner pumps, 2, 50 gpm against 300 psig, motor drive ..... Quimby Pump Co
Burners, 6, horizontal-flare type ..... Riley Stoker Corp
Oil guns, 6, mechanical atomizing ..... The Engineer Co
Combustion control, oil and air operated ..... Republic Flow Meters Co
Storage tanks, 2, 20,000 bbl each ..... Chicago Bridge & Iron Works
Duct work ..... Birmingham Fabricating Co

FEEDWATER EQUIPMENT:

Boiler feed pumps, 2 ..... Ingersoll-Rand Co
8-stage, single-suction, diffuser type, 550 gpm at 2490 ft total dynamic head, 3550 rpm, 2300-v, 450-hp motor drive
Feedwater heater, 7th stage ..... Foster-Wheeler Corp
880 sq ft, 2-pass, 1400-psig water, 350-psig steam
Feedwater heater, 12th stage ..... Elliott Co
Vertical deaerating type, 225,000 lb per hr, 50,000-lb tank
Feedwater heater, 16th stage ..... Elliott Co
Horizontal, 4-pass, 765 sq ft, 250-psig water, 50-psig steam
Evaporator ..... Griscom-Russell Co
7500 lb per hr, single effect, bent tube, 350-psig steam, 100-psig vapor
Evaporator feed heater ..... Elliott Co
Vertical deaerating type, 7500 lb per hr, 15 psig
Feedwater regulator, oil operated ..... Republic Flow Meters Co
Heater drain pump ..... Worthington Pump & Machinery Corp
2-stage, condensate-type, 40-gpm, 300-ft, 3480-rpm, 575-v, 15-hp motor drive
Evaporator feed pumps, 2 ..... Ingersoll-Rand Co
2-stage, end-suction, 20-gpm, 255-ft head, 3450-rpm, 575-v, 5-hp motor drive
Heater drainers and controllers ..... Fisher Governor Co
Combustion-control oil pumps, 2 ..... Worthington Pump & Machy Corp
Rotary-gear, 38-gpm, 100-psi, 1150 rpm, 575-v, 5-hp motor drive

PIPING, VALVES AND INSULATION:

General piping contractor ..... Grinnell Company, Inc
Insulation contractor ..... Phillip Carey Manufacturing Co
Gate and globe valves ..... The Chapman Valve Manufacturing Co; Lunkenheimer Co
Small high-pressure globe valves ..... Manning, Maxwell & Moore, Inc
Check valves ..... The Chapman Valve Manufacturing Co
Stop-check valves ..... Lunkenheimer Co
Miscellaneous valves ..... Atwood & Morrill Co, Crane Co, Fisher-Governor Co, Hagan Corp, Merco-Nordstrom Valve Co, Henry Vogt Machine Co
Steam traps ..... Armstrong Machine Works

INSTRUMENTS:

Draft Gages ..... Republic Flow Meters Co
Flowmeters ..... Republic Flow Meters Co
Indicating-pressure gages ..... Manning, Maxwell & Moore Inc
Recording-pressure gages ..... Republic Flow Meters Co
Indicating thermometers ..... Taylor Instrument Co's
Recording thermocouples ..... Leeds & Northrup Co
Conductivity recorders ..... Leeds & Northrup Co
Water-level recorder ..... Republic Flow Meters Co
Cos recorder ..... Leeds & Northrup Co
Liquid-level indicators ..... Foxboro Co
Instrument boards ..... Clement Industrial Electric Co

ELECTRICAL EQUIPMENT:

Main transformer ..... Westinghouse Electric Corp
18,000-kva, self-cooled, 24,000-30,000 kva, forced-air cooled 13,800-v delta/44,000-v wye, 3-phase
Station-service transformer ..... Westinghouse Electric Corp
2000-kva, self-cooled, 2500-kva forced-air cooled, 13,800-v delta-2300-v wye, 575-v wye, 3 phase
Standby station-service transformer ..... Westinghouse Electric Corp
2000-kva, self-cooled, 2500-kva forced-air cooled, 44,000-v wye, 2300-v wye, 575-v delta, 3-phase
Oil circuit breakers, 46-kv ..... Westinghouse Electric Corp
Disconnecting switches, 15-kv ..... Railway & Industrial Engineering Co
Disconnecting switches, 46-kv ..... Johnson Manufacturing Co
Switchyard structures ..... Lehigh Structural Steel Co
Power and control cables ..... Okonite Co
Station-service switchgear ..... General Electric Co
2300-v metalclad, 2500-v 600-amp breakers with 50,000-kva interrupting rating
Station-service switchgear, 575-v ..... ITE Circuit Breaker Co
Station-service switchgear, 208-v ..... Westinghouse Electric Corp
Motors ..... General Electric Co
Generator neutral reactor ..... General Electric Co
Main control switchboard ..... Clement Industrial Electric Co
Lighting equipment ..... Westinghouse Electric Corp
Storage battery ..... Electric Storage Battery Co

MISCELLANEOUS EQUIPMENT:

Water screens, 2, traveling ..... Chain Belt Co
Turbine-room crane, 25-ton ..... Whiting Corp
Boiler-room hoist ..... Robbins & Myers, Inc
Service tanks ..... R D Cole Manufacturing Co
House-service pumps, 2 ..... Ingersoll-Rand Co
Cooling-water pump ..... Ingersoll-Rand Co
Sump pumps, 2 ..... Yeomans Brothers Co
Chemical feed pump ..... Worthington Pump & Machinery Corp
Service-air compressor ..... Chicago Pneumatic Tool Co
Control-air compressor ..... Chicago Pneumatic Tool Co
Radial brick chimney ..... Alphons Custodis Chimney Construction Co

BUILDING CONSTRUCTION:

Excavation, piling, substructure and superstructure ..... Standard Construction Co
Building steel work ..... Steel Construction Co
Design engineers ..... Commonwealth & Southern Corp

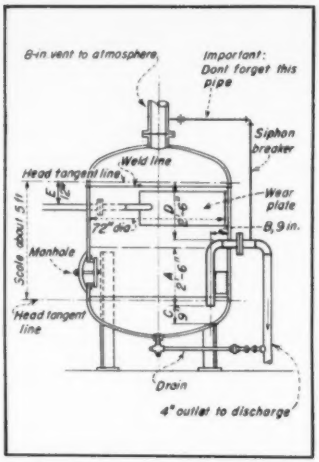
water during the critical load period.

To determine water movement between tides a number of sticks were placed in the river at the plant site at high tide. Stick movements were charted with the changing tides. Samples of water were simultaneously taken from top and bottom at various tide stages and temperature density measured. As expected, the bottom water is cooler and denser. These data—together with calculated dispersion and the fact that condenser-discharge water is hotter than river-surface water during August and hence would remain on top—led us to conclude that three units could be supplied without recirculation. Some slight difficulties might occur with the 4th unit. This was taken care of in the design by placing the intake at —30, the bottom of the river, and discharging cooling water into a creek about 1200 ft from the intake. No difficulties are expected under adverse conditions.

Detail design for No. 2 unit, duplicating original installation and preliminary design for No. 3 has begun. The Gilbert Associates, Inc of Reading, Pa. have been retained to handle this engineering. Construction on No. 2 is scheduled to begin early in 1949. The unit is expected to be in operation in the early summer of 1950.

Design Points You Need To Build a Blowoff Tank

Actual steps in laying out an adequate-sized boiler blowoff tank can get lost in a maze of codes and regulations. To help understand the problem, Stanley H Sye, mechanical engineer, Ford, Bacon & Davis, designs working tank step by step



1 Blowoff tank sketched to scale helps in determining the dimensions needed

► BOILER BLOWOFF TANKS are widely known power-plant equipment. Yet because of the many codes, some conflicting, that govern tank installation, construction, size, vent and discharge lines, the design elements drop out of sight.

But before we talk design let's review the function of a blowoff tank. It is primarily a safety device put in service to stop the practice of discharging a high-pressure boiler direct to atmosphere. In plants where blowoff lines from such high-pressure boilers can be sealed by river, lake, or other large body of water, the blowoff tank may not be needed.

How does the blowoff tank perform its service? It provides the necessary space for blowdown steam and water to lose pressure and temperature before discharge to atmosphere or sewer.

A recent and valuable paper* is the basis for the graph in Fig. 2. This graph, in turn, forms the basis for the following method of blowoff-tank design.

Tank Example. Let's assume a steam generator with a capacity of 460,000 lb per hr at 900 psig and 900 F at the superheater outlet. Pressure drop across the superheater at this steaming rate amounts to 75 psi. Steam pressure in the drum is 975 psig, or 990 psia.

The blowoff tank's vent pipe is arbitrarily picked to give maximum pressure drop of 10 psi between tank and atmosphere. This sets the blowoff-tank pressure during blowdown at 25 psia. From the steam tables we find.

Enthalpy liquid at 990 psia—540.85
Enthalpy sat steam at 25 psia—1160.6
Enthalpy liquid at 25 psia—208.42

*"Flow of a Flashing Mixture," Benjamin & Miller, *Transactions ASME*, Vol 64, No. 7, pp 657-669

With this information as a starter, we can arrive at the pounds of steam flashed to atmosphere per lb of blowdown. We can figure amount of steam per blowdown by equating the enthalpy of liquid at 990 psia to the product of enthalpy of saturated steam at 25 psia, and pounds of steam flashed to atmosphere per lb of blowdown, plus the enthalpy of liquid at 25 psia, less amount of this liquid in steam flashed. Or stated in an algebraic equation: $540.85 = 1160.6\ (X) + 208.42\ (1-X)$. X figures out 0.35 lb of steam per lb blowdown.

So for every pound of water blown down from the boiler, 0.35 lb flash to atmosphere, and 0.65 must go to the holding volume of the blowoff tank. In normal operation this 0.65 lb displaces an equal amount of cool water to the sewer or other point of disposal.

Blowdown Weight. Steam drum of our 460,000-lb-per-hr generator measures 60 in. dia by 36 ft long inside heads. Our blowdown, a customary 4½ in. in the gage glass, can be translated to volume. This volume is 5 ft dia x 36 ft long x 4.5 in. ÷ 12 in. per ft, or 68 cu ft of a liquid at 990 psia with a specific volume of 0.02155 cu ft per lb. Weight of water per blowdown becomes 68 cu ft ÷ 0.02155 cu ft per lb, or 3108 lb. Of this, 0.65 × 3108 goes to the holding volume of the blowoff tanks—total of 2020 lb.

Now let's translate this 2020 lb to its volume in cu ft. Specific volume of liquid at 25 psia is 0.01692 cu ft per lb. So the volume is 2020 × 0.01692, or 34 cu ft going to the holding volume of the blowoff tank.

By *holding volume* we mean the volume contained between the bottom of the internal pipe and the bottom of the outlet connection as indicated by dimension *A*, Fig. 1. This volume should be at least twice the volume of the water entering it per blowdown. It is 68 cu ft minimum here—a 460,000-lb-per-hr boiler, 5-ft drum.

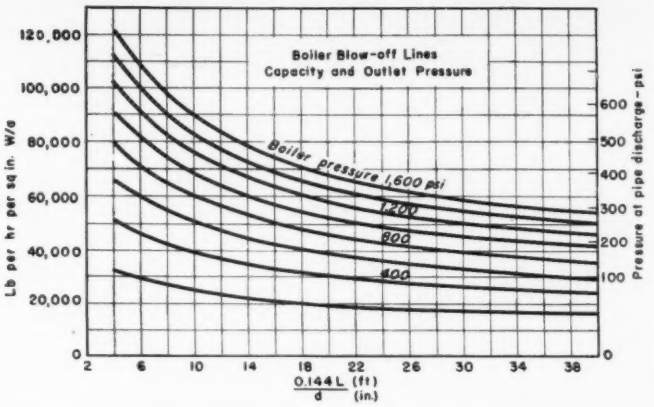
Tank Dimensions. We can now start on the blowoff-tank dimensions. Let's pick one 6 ft in dia. Its cross-sectional area is 28.27 sq ft. With this tank dimension, *A* figures out 68 ÷ 28.27, or about 2 ft, 6 in.

Our next step is to size a vent pipe. From plant layout drawings we can estimate closely the equivalent length of blowoff pipe between boiler and tank, allowing for valves, fittings and bends. For our tank example it comes out as 300 ft of 2-in. schedule-80 pipe. And the equivalent length of vent pipe is 100 ft: The diameter of 2-in. schedule-80 pipe is 1.94 in.

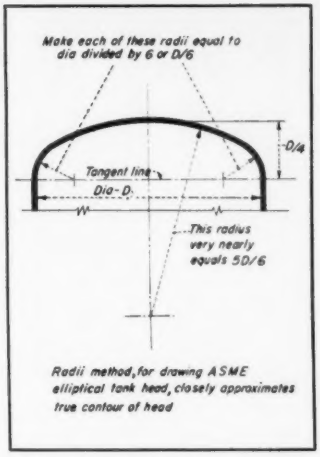
With this background we can compute the factor $0.144\ L\ (\text{ft}) \div d\ (\text{in.})$, the abscissa of Fig. 2, or $0.144 \times 300 \div 1.94$, and get 22.27 factor for the blowoff pipe.

Our chart, Fig. 2, published by Tube Turns, Inc, enables us to pick off the flow rate for a boiler pressure of 975 psig and a factor of 22.27. This shows on the chart as 49,000 lb per hr per sq in. of cross-sectional area. So total blowdown flow rate for a 2-in. schedule-80 pipe of 2.95 in. in cross section is 49,000 × 2.95, and equals 145,000 lb per hr.

Flow Rate. We established, above, that for every pound of water blown down from the boiler, 0.35 flashed to



2 Flow equations for a mixture of water and flashing steam usually involve complicated procedures. Above curves give flow rate and outlet pressure direct


Make each of these radii equal to dia divided by 6 or D/6
D/4
Tangent line
Dia-D
This radius very nearly equals 5D/6
Radii method, for drawing ASME elliptical tank head, closely approximates true contour of head

3 Use of radii allows close approximation of elliptical tank head contour

steam. Therefore, flow rate of flashed steam through the vent pipe amounts to 0.35×145,000, or 50,750 lb per hr.

With our vent pipe, 100-ft, equivalent length, and, as a starter, 6-in. schedule-40 pipe, the pressure drop with a 50,750-lb-per-hr flow is about 25 psi by equation. (Usual Fanning formula for pressure drop, h_L in pipes is $h_L = fLV^2$ divided by 2_gD where h_L is pressure drop; f is friction factor; L, pipe length, ft; V^2, mean velocity of flow, squared; g, acceleration of gravity; D, internal dia of pipe in ft.) This is greater than our original premise of 10-psi maximum drop through the vent, so the 6-in. pipe selected is too small.

Under the same conditions, an 8-in. schedule-40 pipe, 100-ft equivalent length, has a pressure drop of about 7 psi. Therefore, the vent pipe should be this size.

Let's make one more assumption—that the blowoff tank is adjacent to, and above, the circulating-water discharge tunnel. With such an assumption the discharge pipe is short, and the head necessary for flow is only a matter of inches. We can size this discharge pipe by rule of thumb. That is, cross-sectional area of the discharge pipe should be at least four times the cross-sectional area of the inlet pipe, which is 2-in. schedule-80 pipe, or 2.95 sq in. in cross-sectional area. The vent pipe then is four times 2.95, or 11.80 sq in. A 4-in. schedule-40 pipe has 12.73 sq in., and meets this size requirement satisfactorily.

The easiest way to complete the blowoff-tank design is to make a sketch of the vessel to scale, Fig. 1. Draw in the bottom head to any convenient scale, using either an ASME elliptical or an ASME flanged and disked head. An easy method to use when sketching in this bottom head shows in Fig. 3. An ASME elliptical head is preferred, so we will use it for our illustration. By use of radii, as indicated in Fig. 3, the contour of an elliptical head can be closely approximated. So, as we have already decided on a 6-ft-dia tank, we will sketch in this bottom head, using 1 ft for the knuckle radii and 5 ft for the other radius. Distance between the tangent line and the inside of head at center line is 6 ft ÷ 4, or 18 in. See Fig. 3, tangent line and dimension $D/4$.

Next step determines dimension B, Fig. 1. Our outlet-pipe size was determined as 4 in. Now center-to-end dimension of a 4-in. welding elbow ($1\frac{1}{2}R$) is 6 in. Allow 3 in. between end of welding elbow and inside of shell. Dimension B is then 6 in. + 3 in., or 9 in. Dimension C, Fig. 1, should be from 6 to 9 in. Let's use 9 in. for our sketch. Dimension A has already been fixed at 2 ft, 6 in., so we now draw to scale the internal portion of the outlet pipe.

Dimension D should be made at least as great as A, or 2 ft, 6 in., for our example, so we can now complete our tank shell.

Next, add the top head to our scale drawing. This head, of course, has the same dimensions we used for the bottom head. We can now sketch in the 8-in. vent connection to this top head.

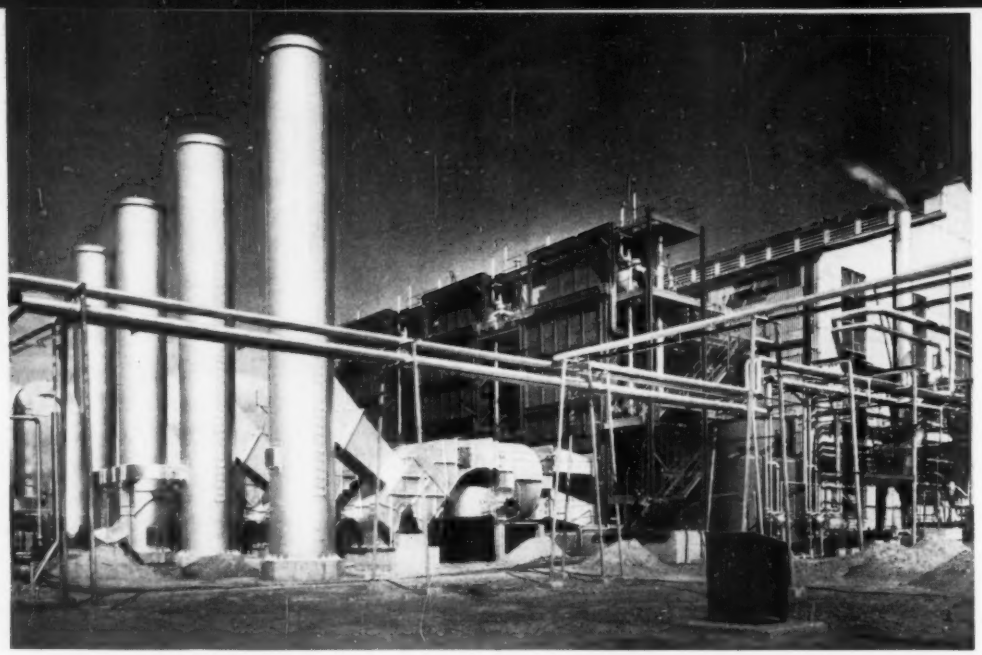
Next step is to locate the 2-in. schedule-80 inlet connection by making dimension E, Fig. 1, equal to dimension D, multiplied by 0.4, or 0.4×2 ft, 6 in. = 1 ft. Note that this inlet connection is to be made tangential.

All that remains is to add the manhole, supporting legs, wear plate, etc, and our sketch is complete. By scaling the sketch, we have a tank 6 ft. in dia by about 5 ft high between the tangent lines of the heads. You may increase the 5-ft dimension if you like, but don't decrease it. Note in Fig. 1 the inclusion of a siphon breaker. Don't forget it.

Our completed scale sketch can now be sent to the drafting room where a finished and properly dimensioned construction drawing can be prepared from it.

For installations in states having no provision in their codes for design of blowoff tanks, shell thickness should be adequate for a working pressure of at least 150 psig, plus a corrosion allowance of ⅛ in. Fabrication should be in accordance with paragraph U-69 of the *ASME Code for Unfired Pressure Vessels.*

Several states, however, require that the blowoff tank be designed for half the boiler pressure. For installations in these states this ruling, of course, must be strictly observed unless relaxation of code requirements can be obtained from a competent local authority.



1 Four outdoor steam generators, 100,000-lb-per-hr capacity, employ separate 60-ft steel stacks for each boiler unit. Natural gas serves as fuel supply with two separate sources for each boiler, one for base load and the other as standby

Abundant Fuel and Water Resources

Full-scale production depends on an adequate power and water supply. Diamond Alkali Co purposely located their Houston Works at Pasadena, Texas where natural gas and water abounds

By J H DUNLAP, *Utilities Superintendent, Diamond Alkali Company*

▶ ADEQUATE WATER and power resources, at hand, mean as much in the manufacture of alkalies and other widely used chemicals as accessibility and abundance of raw materials from which the finished product is derived.

Diamond Alkali Co's Houston Works, a new chlorine-caustic soda plant at Pasadena, Texas, has an hourly steam demand of 400,000 lb and a daily water requirement of 60,000,000 gal. To meet these demands Diamond has built a power plant incorporating standard equipment of the latest design, modified only where necessary to meet special operating conditions or problems characteristic of chlorine and caustic soda production.

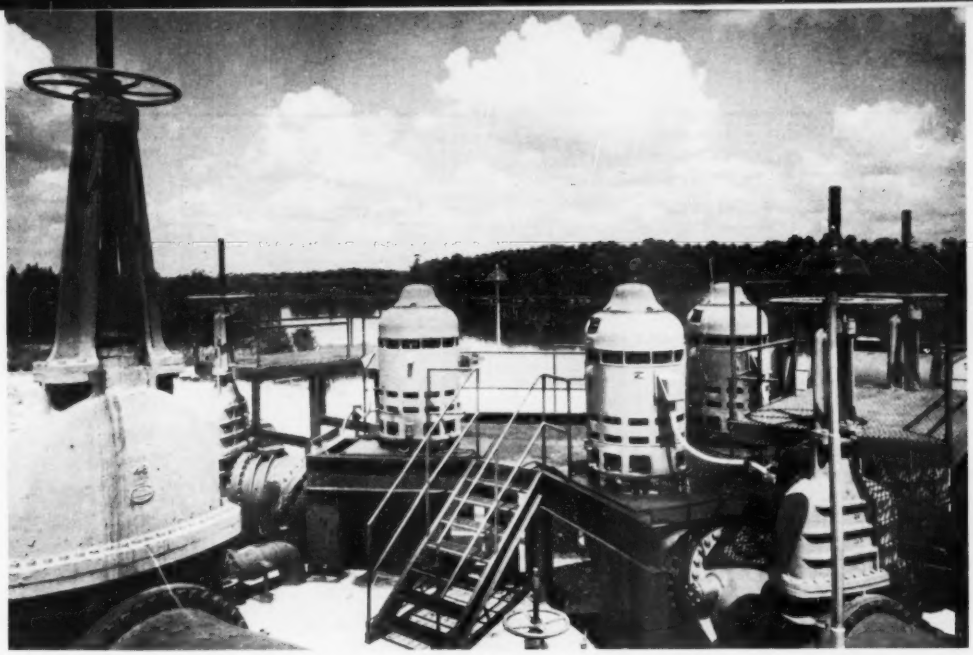
Fuel Supply. Plant's fuel supply is natural gas, one of most abundantly available of the area's natural resources. Instead of securing oil-burning equipment to provide emergency standby insurance against a possible failure in fuel delivery, the plant uses separate sources of gas supply.

Possibility of failure in both systems occurring simultaneously was considered as exceedingly remote. Moreover, eliminating the necessity of using oil reduced capital investment. Beyond this, operating difficulties inherent in trying to burn two fuels of different physical characteristics were avoided. These, among other reasons, made natural gas the logical choice as the answer to the plant fuel problem.

For protection against any eventuality, however, steam-generating units have been so designed that only the addition of burning and soot-blowing equipment permits the utilization of fuel oil if future conditions make this desirable.

The two gas-supply systems divide the load normally this way: carrying the base load on one and meeting additional fuel requirements through regulation for constant pressure with the other. The base-loaded system is controlled by an adjustable flow recorder that has constant pressure superimposed upon it, and is set 10 psi higher than the second system regulating for constant pressure. By this arrangement, deliveries of fuel from each system can be varied suitably to keep the unit price of fuel at the lowest point possible for a given demand.

As supplied from the two systems, gas mixes in a header, which can be sectionalized functionally. This permits operation of two boilers regardless of a failure developing at any point in the setup on the premises. Delivery pressure to the boiler room is 50 psi. Reducing stations at the various delivery points meet the fuel requirements of



2 Cooling water consists of channel water pulled by three 15,000-gpm vertical pumps at intake, above, into a 54-in. 3000-ft reinforced-concrete pipe for all plant distribution. Total water needs, including cooling, 60,000,000 gal a day

Permit Flexible Power Supply Setup

other equipment in other areas. The boilers fire about 14,000,000 cu ft of natural gas daily.

Water System. The water system serving an industrial plant of any appreciable size usually is not one system, but consists of multiple systems. Diamond's plant at Pasadena, Texas with an over-all daily requirement of 60,000,000 gal is no exception.

Here, the system meets six major consumption requirements: (1) well water for brine-well operation; (2) well water for general plant service—fire protection, drinking, sanitation; (3) water from the Houston Ship Channel for cooling, condensing and other equipment; (4) refrigerated water for product cooling; (5) well water for washing out process piping and equipment; (6) boiler feedwater.

Two wells furnish fresh water for operating the salt dome wells from which Diamond secures its salt brine. This fresh water pumps into a 1,000,000-gal storage reservoir. Two pumps, each of 300-gpm capacity, 750-ft total head, force the fresh water from this storage reservoir into the salt dome 3000 ft below the surface.

As this water returns to the surface, it becomes saturated with salt. The resulting brine is stored in a surface reservoir of 1,000,000-gal capacity at Barbers' Hill, 17 miles from the plant.

Plant Service. There are two fresh-water wells on the plant site, each capable of supplying 1500 gpm. One, alone, provides sufficient capacity to meet the plant's projected requirements. In addition, a 300-gpm well, drilled early in the program to provide water for construction purposes, is equipped with a dual vertical electric-motor and gasoline-engine drive, providing an emergency standby source.

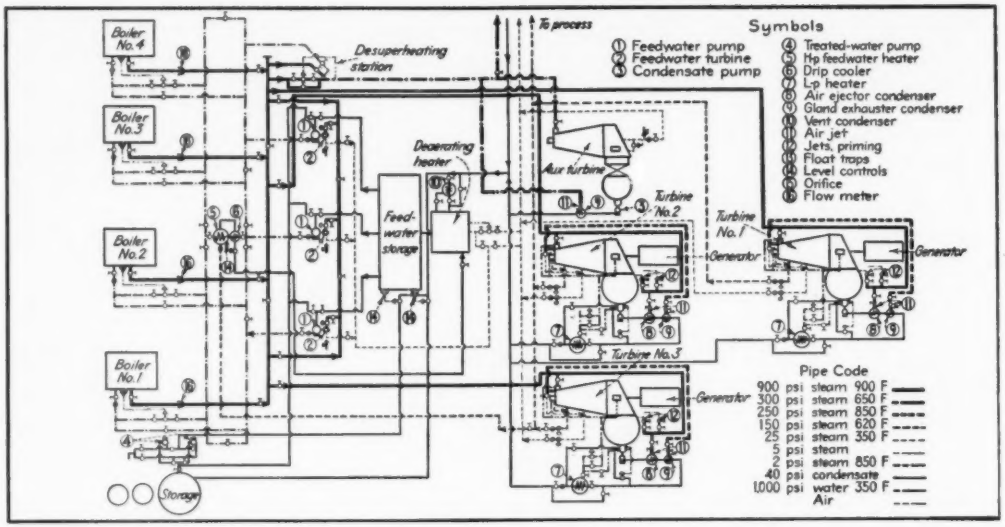
Water pumped from these wells on the plant site has sufficient chlorine added to insure potability. It then enters a 200,000-gal storage tank for distribution through the plant fresh-water system. Chlorinating equipment, of the semi-automatic type, feeds liquid chlorine at a predetermined rate, synchronized with the operation of the motor driving the well. Both wells operate on an "on-off" basis to maintain water between fixed levels in the upper portion of the ground tank.

From the 200,000-gal fresh-water storage tank, two 1500-gpm 160-ft total-head pumps work alternately to maintain level in an elevated 50,000-gal storage tower, 135 ft above ground. The water flows from this tank to the different areas around the plant where it is used for various purposes.

Process Washes. Frequent need for washing out caustic and brine lines to dissolve solidified materials dictates the use of a separate system as a means of eliminating cross connections in the fresh-water supply system. Pumps of sufficient capacity and head have been installed to pump from an open tank to all washout connections, thereby eliminating any possibility whatever of contaminating the potable water.

A loop system, equipped with sectionalizing valves to isolate faulty sections, provides fire protection to the plant. Fire hydrants are spaced throughout the general plant area at 200-ft intervals.

Cooling Water. Cooling water for the plant under maximum conditions totals 41,500 gpm—20,000 for the turbine-generators in the power plant, 18,000 for the caustic evaporators, and 3500 for the chlorine coolers. Each of



3 Thorough valve arrangements shown in above flow diagram indicate the control exercised over the various water and steam lines in power service. Only two of an available four turbine bleed points are now discharging into steam cycle

these cooling applications requires a comparatively large difference in head due to elevation and pressure drop through the processing equipment involved. To avoid the waste of power when pumping against nonrequired heads, three divisions are made: (1) power plant, total head required, 60 ft (2) caustic evaporation cooling, 95 ft (3) chlorine cooling, 125 ft.

Pumping all the channel water required from the intake station to the plant site at the lowest required head and then installing supplementary pumps of sufficient volume and head to meet the needs of those areas requiring higher heads produced the most economical cooling-water system. So, three 15,000-gpm 60-ft total-head vertical propeller-type motor-driven pumps, Fig. 2, were, therefore, installed at the intake on the channel and a 54-in. 3000-ft reinforced-concrete pipe, laid to deliver all the cooling water to the plant area. Within the plant limits this line branches into two 42-in. reinforced concrete lines, one serving the power house and the other the booster station.

Three 9000-gpm 35-ft total-head horizontal motor-driven centrifugal pumps serve the caustic evaporation area.

Two 3500-gpm 65-ft total-head single-stage horizontal motor-driven pumps handle water for chlorine cooling. One is used for everyday operation, while the other serves as a spare. All circulating water is chlorinated for algae and slime control by "sniff gas" vented from the chlorine recovery system.

Boiler Feedwater. Boiler feedwater normally runs over 95% condensate. Every effort has been made to recover every gallon of condensate not contaminated by product leakage during processing, Fig. 3. Makeup comes from the second effect caustic evaporator heaters, each of which has a normal carryover of less than 10-ppm caustic and an equal amount of sodium chloride.

Condensate obtained from this unit is neutralized with sulphuric acid to keep the caustic content of the boiler water within the desired limits. All boiler feedwater returns through a 500,000-lb-per-hr deaerating heater, which reduces the oxygen to less than .055 cc of oxygen per liter.

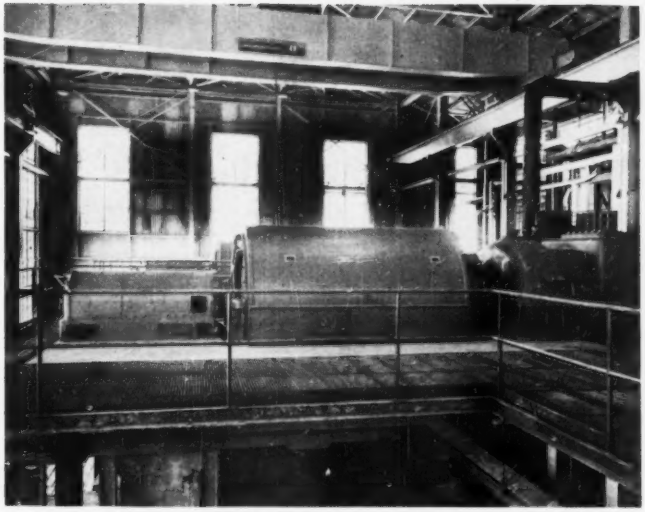
This heater, a horizontal tray-type unit with two vent condensers operating in parallel, mounts over a 12,000-gal storage tank. Steam piping is so arranged that it permits the exhaust from the boiler feed pumps to discharge into the heater, supplemented by a constant-pressure regulator from the eleventh-stage bleed on the main turbine.

The high-pressure heater and drip cooler are installed between the feedwater pumps and the boilers. This heater, a 2-pass U-tube pressure-sealed head design, uses the fifth-stage bleed for heating the feedwater. At full load the outlet temperature reaches 356 F. Condensate from the high-pressure heater goes through the drip cooler, which is of similar design.

Boiler Feed Pumps. Three 500-gpm 3450-rpm horizontal centrifugal pumps with single-suction impellers, mounted back to back to insure hydraulic balance, supply boiler feedwater. Maximum temperature of the water is 240 deg F, the total head 2450 ft. Turbines, 500-hp single-stage, drive these units. Initial steam conditions at the throttle are 850 psi and 900 F. Normal backpressure of these units is 15 psi, but they are capable of delivering rated horsepower with 40-psi backpressure.

Boilers. Four boilers, suitable for outdoor operation and with a normal rating of 100,000 lb per hr and a maximum capacity of 125,000 lb per hr, meet the steam demand, Fig. 1. The furnace for each unit is completely water-walled with roof and floor screen tubes. A steel casing encloses the setting.

The turbine room is extended to cover the firing aisle to afford protection to the operators. Each boiler has its own forced- and induced-draft fans and a regenerative-type air heater. Constant-speed motors drive the fans, with air flow controlled by vanes on the suction of each fan. Each boiler has a steel stack 60 ft high to exhaust flue gas into the atmosphere. Natural gas, the fuel for firing, enters through four ring-type burners installed in each boiler.



4 Three 10,000-kw 850-psi 900-F turbine-generators, exhausting into a vacuum, supply power. Two bleed points now blanked off will some day heat feedwater

Fuel and water feed are completely automatic, with a Bailey control system used in both cases. Constant steam pressure is maintained on the steam header by the control varying gas and air flow, whose ratio is adjusted by a steam-flow air-flow meter. The induced fan regulates the furnace pressure. The water-inlet valve, with 2-element control, is actuated by steam flow and readjusted for water level. Constant differential across the control valve is maintained by throttling the steam to the turbine to control the boiler-feed pump speed automatically.

Piping. The general piping system, featuring simplicity of design and construction, follows latest approved practices for power-plant use. Of chrome-molybdenum seamless-steel tubing, all high-pressure steam piping has been fabricated by welding.

Use of motor-driven auxiliaries necessitated an auxiliary source of power to get the main turbine on the line. A connection from an outside source meant a considerable capital investment. Similarly, operating cost for standby service would run high. These factors, coupled with the slow delivery and high initial cost involved in purchasing a new turbine, led us to secure a used turbine in serviceable condition and capable of supplying at least 500 kw for operating the necessary auxiliaries to get one of the large units on the line.

The equipment finally selected was a 1000-kw 3600-rpm direct-connected turbine-generator requiring initial steam of 250 psi at 650-F total temperature, which could operate either condensing or noncondensing, and also incorporate automatically controlled extraction. Put into operation two months before completion of the large turbines, it served as a source of power during the remaining construction period, permitting trial operation of all motor-driven machinery and equipment in the plant.

Automatic extraction was employed to supply the caustic evaporators with steam for trial operation and to meet the limited demand for steam to treat the brine for cell feed. It also furnished steam during the time of low load on the main generators when the stage pressure was not high enough to meet the requirements.

A 50,000-lb-per-hr pressure-reducing and desuperheating station was purchased to reduce pressure from 800 to 250 psi, and temperature from 900 to 650 F to supply the turbine. The condensing-water rate is 20 lb per kw. Maximum extraction rate of 40,000 lb per hr was used during preliminary operation.

Main Turbines. The main turbines Fig. 4, are three 10,000-kw 0.8 pf 3600-rpm 17-stage direct-connected air-cooled turbine-generators, each of which requires 850 psi at 900-F total temperature and 3-in. Hg backpressure. Each unit provides four bleed points—at the fifth, seventh, eleventh and fourteenth stages.

Seventh and fourteenth stages are blanked off and will be used for stage feedwater heating should future additions require a controlled extraction and backpressure machine. Inclusion of this feature did not add materially to the cost of the turbine as it follows normal bleeding as practiced by public utility companies.

To obtain the quantities of steam required for caustic evaporation—36,000 lb per hr at 100 psi, 150,000 lb per hr at 10 psi—the twelfth stage was restricted to permit bleeding the large quantities at the eleventh stage. Pressure at the eleventh stage is controlled by load division on the machines that are in operation.

Condensing Equipment. Condenser for each turbine is a 2-pass divided waterbox surface condenser providing 5500 sq ft of condensing surface. Tubes are $\frac{7}{8}$-in. 18-gage, 20 ft $\frac{1}{2}$ in. over-all length, arsenical Admiralty tubes, rolled at both ends into Muntz metal tube sheets. The condenser bolts solidly to the turbine and is spring-supported to keep the turbine flange loading within the manufacturer's limits.

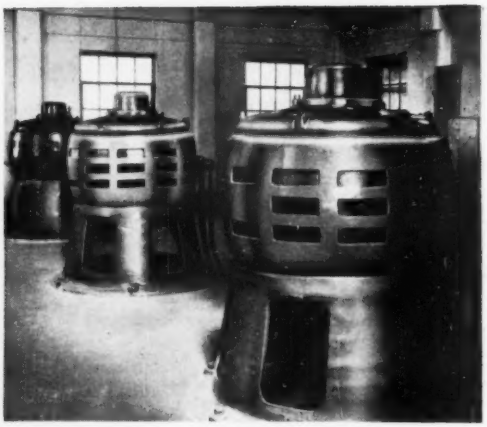
Air-removal apparatus comprises twin 2-stage ejectors equipped with inter- and after-coolers, and a hogging jet of large capacity for the starting-up period.

The large process requirements of steam permit a much smaller condenser than normally employed for a 150,000-lb-per-hr throttle flow. Only 50,000 lb per hr is rejected to the condenser. In view of the possibility in the future of bleeding the turbine-generators only for feedwater heating, a condenser shell of adequate size was purchased but with only enough tubes installed to meet the present condensing demand. Such an arrangement supplies desired flexibility.

Generators have both main and pilot exciters directly connected. The lubrication system of the generators and exciters is common with the turbine. The generator has a surface air cooler and a closed cooling system. Exciters are cooled with filtered turbine-room air.

General Considerations. The extraordinary amount of attention the designers gave to the many details of the water and power facilities was prompted by the basic importance these key factors hold in the minds of the management of Diamond Alkali Co. No stone was left unturned in setting necessary provisions for these vital services.

CENTRIFUGAL PUMPS with enclosed nonclogging impellers, 8000 gpm, 18-ft head, are driven by 60-hp wound-rotor motors



THREE VERTICAL AC MOTORS, 60 hp, are started in any sequence by a simple float-switch control, plug-in connections

Plug Connections Solve Pump-Motor Float-Switch Control Problem

Extension cords, plug connections did the trick when we needed a simple, reliable, low-cost way to set up float-switch automatic starting of pump motors in any sequence

By M H KINSINGER
Chief Mechanical Superintendent
Washington, D. C., Sewer Division

► LOAD AT ONE of our sewage pumping substations increased to a point where we needed larger equipment. So our design section planned three pumps, each a 12-in. trash centrifugal unit with enclosed impeller, rated 8000 gpm at 18-ft head, driven by a 60-hp 220-v wound-rotor motor.

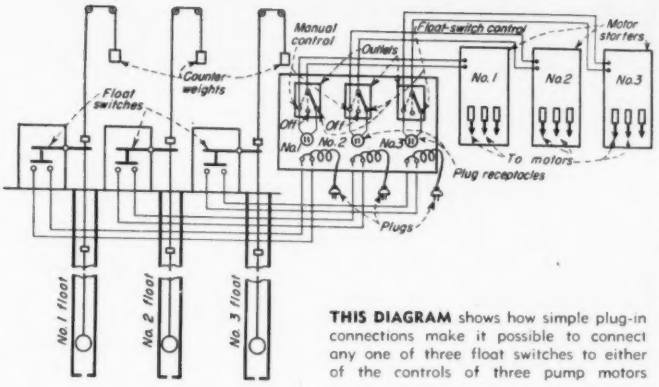
Before installation of the new units, three men had operated pumps and kept the substation clean. They worked seven days a week, providing 3-shift operation at relatively low cost. But a shorter work week, increased leave and holiday privileges, and rising salaries increased costs to where we decided to eliminate the attendants. As a substitute we planned a one-shift inspection and maintenance crew to take care of a group of substations. This change raised the interesting problems of how to: (1) operate all three units automatically as needed and (2) equalize operation on the three units.

Automatic Operation. Automatic controls were not so well developed then as now, but we were able to get single-pole float switches. We used a type operated by sash chain passing over pulleys between float and counterweight with adjustable stops for actuating the switch. We installed three 8-in.-round copper floats in 10-in. standpipes with perforated caps on their bottom ends to reduce float surges. We then set the first switch for the predetermined 5-ft pump-down. Cutoff point was determined by selecting lowest level that kept pumps primed under all conditions. To insure against accidental pumping below that point, with possibility that pump might be airbound, we vented the casing by drilling and tapping just below stuffing box, for ¾-in. pipe, which we ran up and tapped into high point on the discharge line. Cut-in point was selected as the highest point in the wet well where sewage would not back up in the main sewer. We called this float No. 1 to take care of normal operation.

This pumping station, which handles combined sanitary and storm sewage, is subject to severe flow increases during storms. We set the second float with the cut-in point 6 in. above the first, and the third cut-in 6 in. above the second. This took care not only of increased flow but also of accidental failure of the first or second unit to start. If for any reason sewage rose 6 in. above the first float cut-in point, the second unit went into operation; if water continued to rise 6 in. more the third unit started.

To preserve the operating sequence that the inspector intended the units to run, we set the second float cutoff point about 2 in. above the first, and the third about 2 in. above the second. Location of the three standpipes, in relation to pump suctions and incoming line, determined the cutoff point settings necessary to insure that pumps come off the line in reverse order from that in which they started.

Equalizing Operation. Second problem was to arrange the control wiring



THIS DIAGRAM shows how simple plug-in connections make it possible to connect any one of three float switches to either of the controls of three pump motors

to equalize the running time on the three pumps. The solution was not arrived at quickly, but it was simple when we got it. We first asked the pump contractor to include such a device with his control equipment. His subcontractor furnished nine switches, three for each unit, but this setup did more than we wanted. It permitted all three units to be put on any one float, which was not desirable and might kick the station out of service by starting three units simultaneously.

We solved the problem by mounting in a box three outlets, to each of which we ran the 2-wire control circuit from a motor starter, as in diagram. We then ran the two wires from each float switch to the same box, and attached about 18 in. of flexible 2-wire cord with an attachment plug on the end. We numbered outlets and plugs so all that was necessary to arrange any operation sequence was to plug into the outlets that gave the desired results.

Control circuits energize the magnet coils of the starters' primary contractors, and so carry relatively low amperage. Even if the plug were pulled accidentally while the motor was on the line, no damage would result. For convenience we installed Hand-Off-Auto switches in the same box with the outlets. These permitted switching any pump on manual or float-switch control, or opening the control circuit if necessary.

With this type installation make sure that the float switches—in which there is no current except when connected to the starter—are always connected to the attachment plug. When the control wires are connected to the plug there is always danger an operator will get a shock from the plug's exposed prongs. If the plug accidentally hits the metal box, and shorts the prongs, the motor will start. We learned this the hard way.

In ordinary 2-wire control it makes no difference about polarity, but we have also used this control method with three wires, by substituting 3-wire polarized plugs and outlets. We have improved the setup by using double-pole float switches and connecting the two poles in parallel for single-pole, multiple, make-and-break operation.

Recently we installed some modern float switches, but for simple trouble-free operation we still prefer our old-style chain-operated design with makeshift transfer panel.

Electrical Deaeration of Boiler Feedwater

By E T PINKNEY, R DICK, W B DOUGLAS and R S YOUNG*

▶ WE ARE INTERESTED in V Rodwell's article, "Electrical Deaeration Licks Corrosion in This Plant," in May 1947 POWER.

There seems no doubt that dissolved oxygen was entirely eliminated by passing an electric current through boiler feedwater that had an initial oxygen content of at least 0.06 ml per liter. We are puzzled, however, by the explanation ". . . if decomposition of a liquid takes place when a current passes through it, the method might also prove practicable, not only to remove the free oxygen but also to destroy the water's affinity for oxygen by charging it to a potential just under electrolysis."

Electrically deaerated samples of feedwater subjected to Winkler tests apparently showed no blue color with starch; neither did the blue color appear after many hours' exposure to atmosphere. Rodwell offers the explanation that treated water had lost its affinity for oxygen.

Iodine Release. We feel this explanation is not strictly accurate. Chemistry of the Winkler test is well known, and no further iodine is released by exposure to oxygen after the sample is fixed by acidification. Return of the blue color after titration is due to the decomposition of potassium iodide to release iodine under the influence of light and heat.

We attempted to use Rodwell's procedure for similar deaeration on Nchanga boiler feedwater. Here, feed is untreated condensate and evaporated makeup with a conductivity of less than one reciprocal megohm. We duplicated the Slough tests but had to add salts to the water to get current to flow. We used carbon electrodes of spectograph quality and a potential of 3 volts from dry batteries. Separately or together in concentrations common to feedwater, we added: sodium sulphate, sodium carbonate, sodium phosphate, calgon and quadrafos to the water but could not reduce the dissolved oxygen content electrically.

Chlorine Presence. But an artificial feedwater containing 500 ppm sodium

(*Continued on page* 142)

* The four authors are employed by Nchanga Consolidated Copper Mines Ltd., Chingola, Northern Rhodesia, in the following capacities: E T Pinkney, chief chemist; R Dick, assistant chief chemist; W B Douglas, assistant resident engineer; R S Young, chief research chemist.

SPEAKING OF POWER

This one bears repeating. According to *Time*, printers at the Detroit *News* mixed 40 lb of perfume oil with their ink to put out scented full-page ads plugging the "magical allure of Dana's Tabu perfume." The heady aura drifted out of the press room and into editorial and advertising offices, where it lingered lovingly on staffers' clothes and hair. Even with air conditioning going at full blast the smell hung on for two days. Toughest problem faced male members of the staff, who had a rough time dreaming up convincing explanations for their wives.

★ ★ ★ ★

Fred Brewster of McGraw-Hill World News London office reports that Anglo-Saxon Petroleum Co has ordered a 1200-hp gas-turbine-electric propulsion set for the new 8200-ton tanker *Auris*. British Thomson-Houston Co will build the unit, which will take the place of one of four diesel sets normally employed in this class of vessel. Purpose is to compare fuel economy of gas-turbine drive with other forms of power. The new unit is expected to be ready for installation in about a year. It will then receive extensive sea trials.

★ ★ ★ ★

In the U. S., attention now focuses on stationary gas turbines. Central Maine Power Co has placed an order with General Electric for a 3500-kw oil-fired unit similar to the one now being built for Oklahoma Gas and Electric Co (POWER, Sept 1948, pp 64-71). Three 5000-kw high-efficiency gas-turbine plants, with regeneration and intercooling, have also been ordered from GE One, oil-fired, goes to Bangor Hydro-Electric Co, and two, gas-fired, to Public Service Co of Oklahoma.

★ ★ ★ ★

Readers often ask how we go about preparing a special section such as the 48-pager on "Fuels and Firing" in December. They are usually curious about our reasons for handling these exclusively as staff operations and invariably want to know how much time such a job involves. This is no place to rehearse the whole grim tale of what can only be described as a backbreaking, even though rewarding, operation but a few highlights paint the picture.

First, why staff-write special sections? Why not pay specialists to do it for us? That would certainly be easier, and probably less costly, but we are convinced our method is better. Here's why: From long experience we have learned what our readers want, and the best ways of presenting it to them. Thus the skilled technical editor serves as interpreter between the engineer specialist and the engineer reader. He asks the questions the reader needs answers to and then puts the answers in a form that makes for ready understanding. Of equal importance, the technical editor is the only one who can put all the parts—text, captions, tables, drawings—together to make a unified whole that will convey maximum information in minimum time.

So we do the job ourselves. How long does it take? Special sections are planned a full year in advance and collecting raw material starts about six months ahead. Then comes the tough grind of digesting hundreds of pounds of reference material—catalogs, bulletins, textbooks. Gradually the substance of the special section takes shape—illustrations are selected and our draftsmen instructed as to best methods of handling, text and captions written. Rewriting for absolute clarity, and pruning to fit space limitations follow. Then checking and double-checking. It's not unusual to consult four or five references to get the facts needed to write one sentence and as many more to check.

What does all this add up to? The recent "Fuels and Firing" special section represents more than 1500 manhours of editorial staff time, exclusive of preliminary letter writing and research, and of time spent in the drafting and art department. Put another way, it adds up to 48 pages of concentrated information, which, if past performances are any guide, will meet with a hearty welcome from power engineers everywhere. We think it's worth it.

★ ★ ★ ★

Speaking of special sections again, the December 1945 job on steam turbines continues to move up in the best seller list. It's not in the *Gone with the Wind* class yet but we have filled orders for more than 20,000 copies over and above the original distribution in POWER and are now working on the third printing. Some time ago the editor of *Ingenieria Internacional* had a Spanish translation prepared and published a condensed version as a special section in that magazine. *The first response to its appearance was a request for an English translation!*

★ ★ ★ ★

Continuous operation at full load for more than a quarter of a century is the record of a 10,000-kw hydro generator owned by Washington Water Power Co, on the Spokane River. It has just had its first overhaul since it was installed 26 years ago by GE. Only major replacement was the turbine bearing.

★ ★ ★ ★

Tongue in cheek, the *New Yorker* quotes a traveler recently returned from the Pacific Northwest, who was vastly impressed with the Columbia River and its tremendous hydro projects. He was also impressed with the tidy thoughtfulness of one equipment builder, whose nameplate carries this adjuration: "These turbines should not be operated or maintained without first reading the instructions."

★ ★ ★ ★

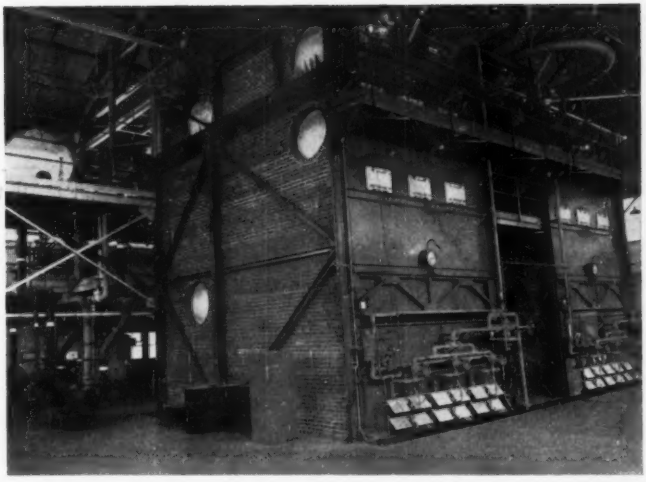
The *New Yorker* quote reminds me of the days when I was a small cog in a big engineering department, putting in the last two units at Hudson Avenue Station of Brooklyn Edison. These were 160,000-kw machines, then, and probably still, the largest single-shaft single-winding units in the world. I well remember that we had to bulge the walls a bit to get them into the existing turbine room. Viewing more than 85 ft and Lord only knows how many hundred tons of turbine-generator, I couldn't help chuckling each time at one line on the nameplate. Obviously added by a literal-minded patent attorney, it read "Not licensed for aircraft." Of course, the joke could be on me—maybe we'll have aircraft power units that big some day.

THIS MONTH'S COVER

On page 100 you'll find details of the new sulphite-pulp process in use at Weyerhaeuser's Longview mill. Substituting magnesium oxide for the usual calcium base in the cooking liquor makes it possible to burn the waste liquor. In one fell swoop this (1) generates steam (2) recovers chemicals, and (3) eliminates a disposal problem. The cover dramatizes the recovery boilers that form the heart of the new installation. Photo was taken at upper drum level.

COLUMBIA STEEL CO's new sheet and tin mill at Pittsburg, Calif.: Main mass of buildings in center is new mill, with clarification and filtration plant at left, by overhead water tank. Boiler house is behind last new building, at the right

Power for Pacific Coast Steel



STEAM FOR NEW MILL comes from two 4-drum boilers designed to supply 58,000 lb per hr each, saturated. Normally gas fired, units are equipped for emergency oil firing. Boiler-feed pumps are visible on the operating floor at the far left

► POWER SERVICES play an important part in the new cold-reduction sheet and tin-plate mill at the Pittsburg, Calif. plant of Columbia Steel Co, Western subsidiary of United States Steel. This unit will add more than 300,000 net tons annually to the supply of steel products made by West Coast plants for Western industry.

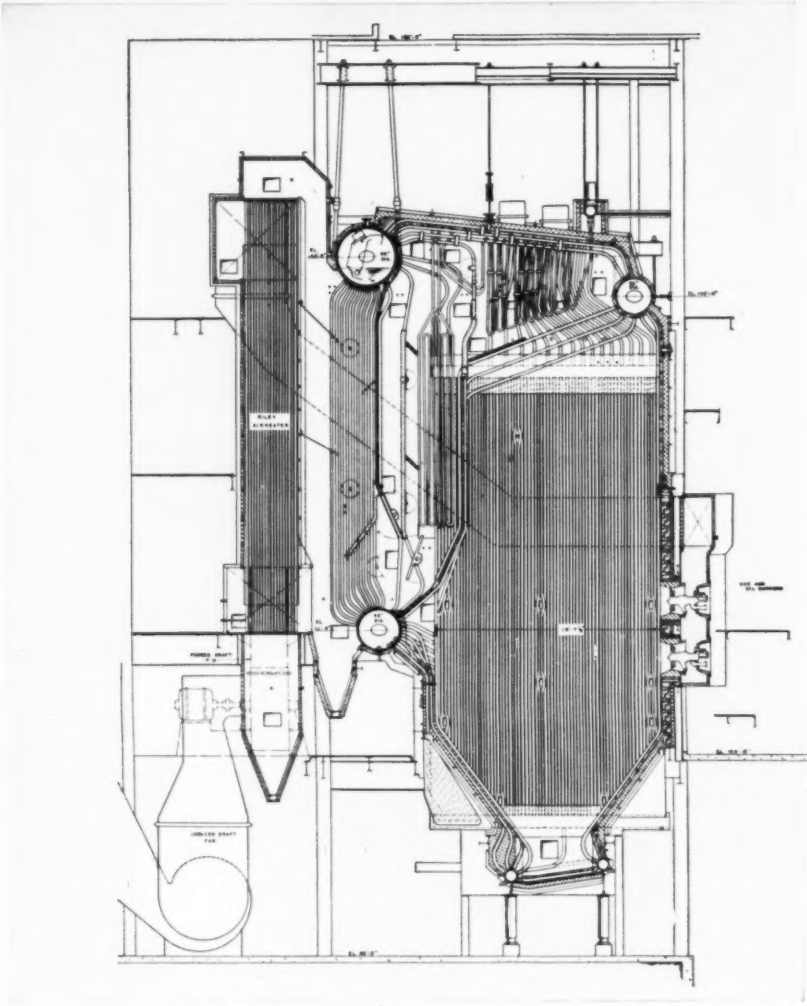
Upon completion of the current conversion of the Geneva, Utah plant, built by United States Steel to produce ship plates and structural shapes during the war, the Pittsburg, Calif. unit will receive hot-rolled coils of semi-finished steel made from Utah ores, coal and limestone, for processing to cold-rolled sheets and tin plate.

Power Services. Electric power for the Pittsburg plant is purchased; steam-generating and power-service equipment has been installed to serve the new cold-reduction mill added to the already diverse facilities of the unit.

New steam-generating plant con-

(*Continued on page* 98)

Riley Steam Generating Units



South Carolina Power Co.—Hagood Station—Charleston, South Carolina
230,000 lbs./hr. Riley Steam Generating Unit
975 lbs. Pressure. 860° F. Steam Temperature. Initially Oil Fired
Riley Pulverized Coal equipment will be installed this year
Two additional units. 1—230,000 lbs./hr. and 1—310,000 lbs./hr.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul
Pittsburgh Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Tulsa

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

selected for Hagood station

South Carolina Power installed their first Riley Unit in 1946. Two additional Riley Units will be installed in 1949, together with Riley Pulverizers for all three units.

South Carolina Power Company selected a 230,000 lbs./hr. oil-fired Riley Steam Generating unit as unit No. 1 for their Hagood Station at Charleston, South Carolina. When increased demand necessitated enlarging the station, a substantially duplicate Riley unit was selected as well as a 310,000 lbs./hr. Riley unit.

Due to the relatively lower cost of coal at the present time, it was decided to convert the first unit from oil firing to coal firing and to install the new units initially for coal firing. Riley pulverizers, with the pulverizer elements faced with tungsten carbide, were selected for all three boiler units.

Similar Riley Units also at Gulf Power and Mississippi Power plants

Gulf Power Company and Mississippi Power Company have also installed five Riley units similar to the unit illustrated. Throughout the South the use of Riley pulverized coal-fired steam generating units has expanded rapidly. Look over the accompanying list of recent Riley units in the South. Houston Lighting & Power Company alone has installed or has on order nine Riley Steam Generating units having a steam capacity of 4,590,000 lbs. of steam per hour.

Riley users will tell you—you can rely on Riley

The regularity with which Riley Steam Generating unit users repeat for additional Riley units when plants are expanded is positive proof of the excellent performance of Riley units, their reliability and the satisfactory service rendered by the Riley organization. Riley users will gladly confirm that "you can always rely on Riley."

A Few other recent Riley Installations in the South

Gulf Power Co., Pensacola, Fla.
2-230,000 lbs./hr.

Mississippi Power Co., Hattiesburg, Miss.
3-230,000 lbs./hr.

New Orleans Public Service Co., New Orleans, La.
1-330,000 lbs./hr.

Houston Lighting & Power Co., Houston, Tex.
2-850,000 lbs./hr.
2-675,000 lbs./hr.
2-400,000 lbs./hr.
1-350,000 lbs./hr.

Arkansas Power & Light Co., Little Rock, Ark.
1-925,000 lbs./hr.

Southwestern Public Service Co., Borger, Tex.
1-330,000 lbs./hr.

Northern Virginia Power Co., Winchester, Va.
1-350,000 lbs./hr.

Champion Paper & Fibre Co., Canton, N. C.
1-300,000 lbs./hr.

Celanese Corp. of America, Celriver, S. C.
3-150,000 lbs./hr.

Riegel Textile Corporation, Ware Shoals, S. C.
1-130,000 lbs./hr.

Ecusta Paper Co., Pisgah Forest, N. C.
2-80,000 lbs./hr.

Gaylord Container Co., Bogalusa, La.
1-210,000 lbs./hr.

Savannah Sugar Refining Co., Savannah, Ga.
1-100,000 lbs./hr.

University of Maryland, College Park, Md.
1-100,000 lbs./hr.

Congoleum-Nairn, Inc., Cedarhurst, Md.
3-35,000 lbs./hr.

Commercial Solvents Corp., Sterlington, La.
1-110,000 lbs./hr.

Celanese Corp. of America, Narrows, Va.
1-200,000 lbs./hr.

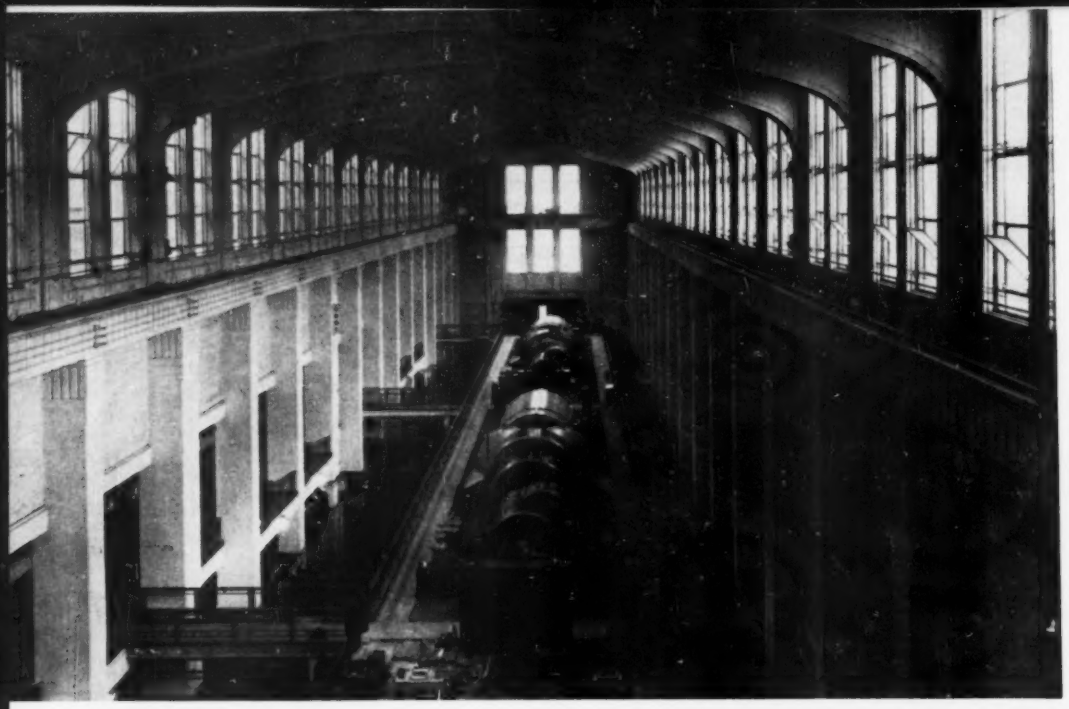
Calco Chemical Co., Piney River, Va.
1-80,000 lbs./hr.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

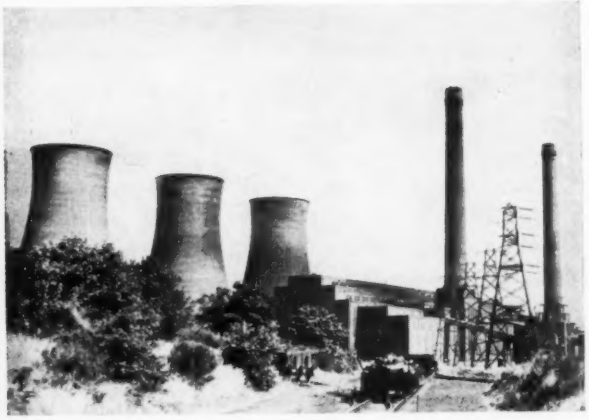
. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS



TWO 50,000-KW TURBINE-GENERATORS comprise the initial installation of station to house ultimately six units with total capacity of 300,000 kw. Each turbine is supplied steam by two 320,000-lb-per-hr boilers, at 670 psig and 845 F

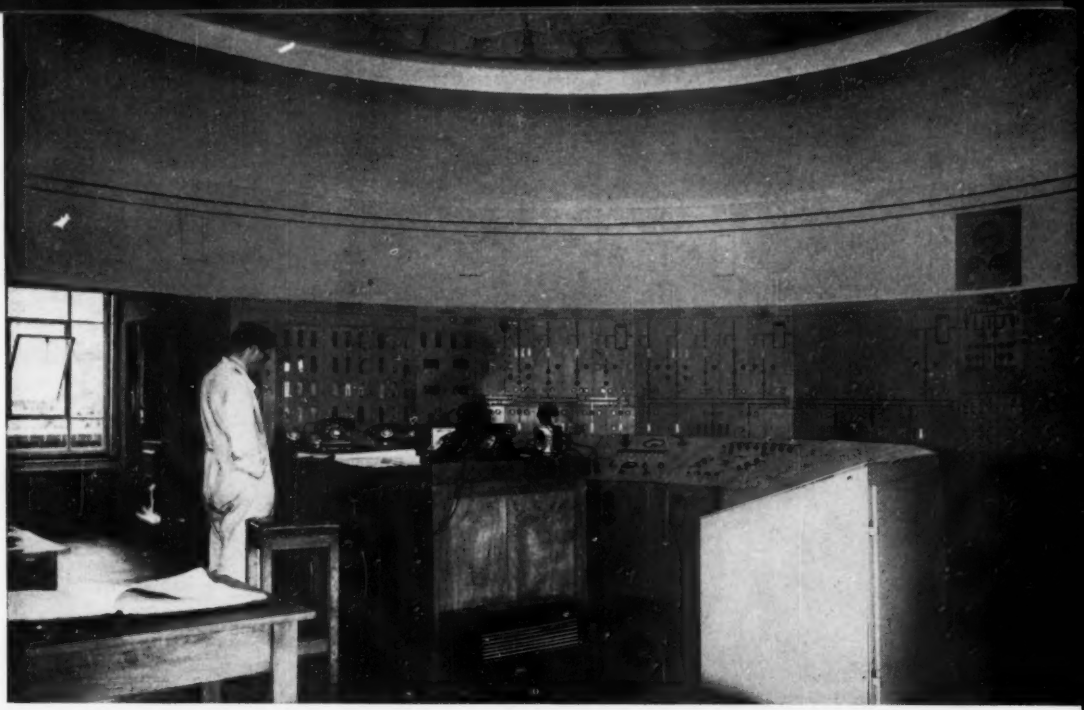
Hams Hall Station



HAMS HALL STATION will ultimately have four cooling towers and three stacks. Pulverized bituminous coal of wide characteristics fires boilers

←

CONDENSER CIRCULATING WATER flows around feet of cooling tower on its way back to main unit. Each tower handles 5,000,000 gal per hr

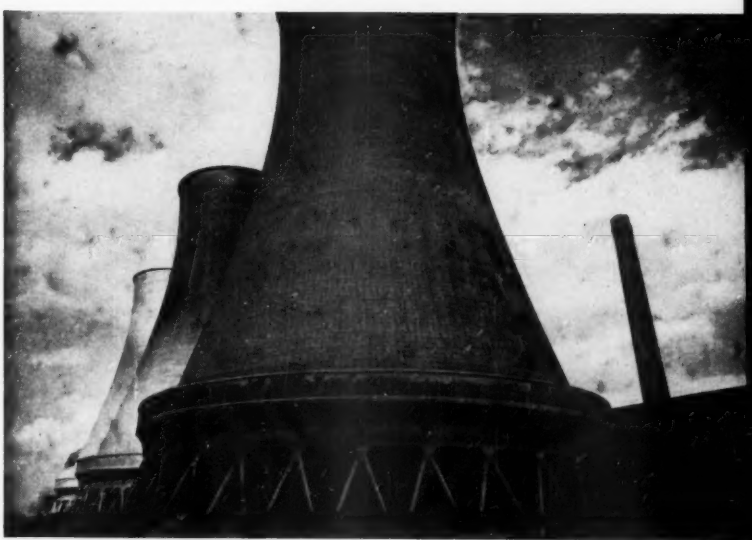


CENTRAL CONTROL ROOM supervises turbine loading and high-tension station switching. All switching designed for 33,000-v operation, with transmission to load areas stepped up to 132,000 v. Station will be the largest in England

Features Largest Cooling Towers

▶ HAMS HALL STATION near Birmingham, England, will be the largest station in that country when completed with an ultimate capacity of 300,000 kw. The 12 boilers, 320,000-lb-per-hr capacity each, will be pulverized-coal fired. Bituminous coal of widely varying combustion characteristics will be used, the ash will be disposed of on the large area of land surrounding the plant. Boilers will supply steam at 670 psig and 845 F. Each pair of boilers will be supplied by two 600,000-lb-per-hr boiler feed pumps, one motor driven and the other turbine driven. Electro-static precipitators operating at 60,000 v will provide flyash removal from stack gas.

Each main condenser has three sets of 2-stage steam-jet air ejectors, two of which will be able to take care of maximum loads. The cooling towers, which mark the appearance of the plant, are the largest yet built in England—they are 320 ft high and 226 ft in diameter at the base. No information was released on the type of tower, but they appear to be natural draft.



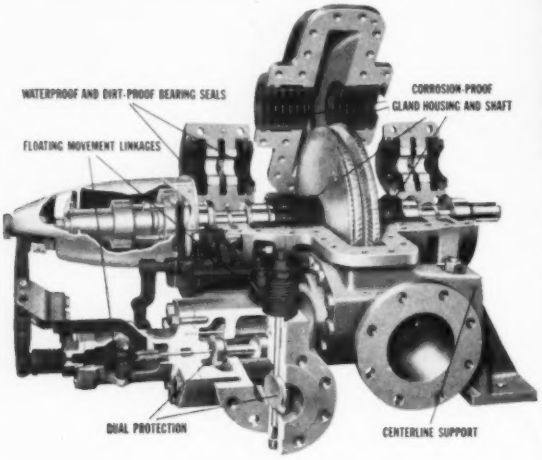
WATER FROM COOLING TOWERS is handled by three circulating pumps for each unit. Each pump can take care of one-half individual condenser-water requirements

Where the going is

Water-test periods running for hours and hours with turbine *operating* and *standing still*—prove the effectiveness of Type E bearing seals against water contamination of the lubricating oil.

Dust-like, hard abrasive sprayed on the Type E operating at full speed . . . none of the abrasive entered the bearing housing . . . governing and overspeed mechanisms operated freely.

Floating movement of the governing and trip linkages is assured with corrosion-resisting parts, ball and socket joints, large clearance for free movement of the assemblies. The unique design of Type E prevents the accumulation of sludge or mud packs where the operation of the governing or trip linkages might be impaired.

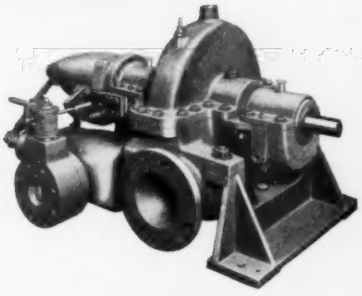


Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

TOUGH!

Count on TYPE E



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In wet or dry locations . . . outdoors in any kind of weather . . . in subbasements . . . or anywhere a turbine may be required . . . the Type E operates dependably, economically and efficiently.

The Type E is engineered to eliminate or minimize many maintenance problems that could be troublesome, ordinarily. Such features as weatherproof bearing seals, corrosion-resisting gland zones, centerline support, Dual Protection against overspeed, floating movement of governing and trip linkages, and parts interchangeability are a few of the "reasons why" Type E turbines are the choice for rugged, trouble-free, economical drives.

Get all the facts. Call your nearest Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. Send for Booklet B-3896. J-50488-A

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PUMP DRIVES

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COMPRESSOR DRIVES

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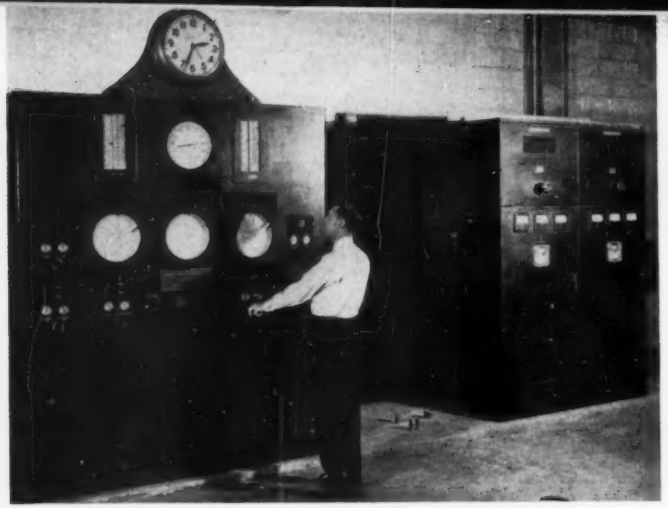
DRIVES FOR
Paper Machines, Jordans, Beaters, Coal Pulverizers and Line Shafts

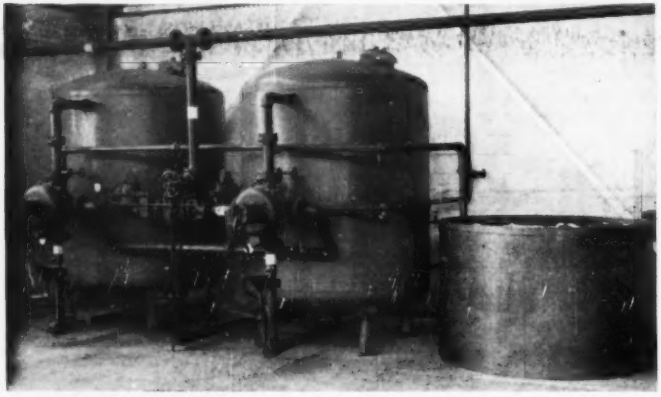
YOU CAN BE SURE... IF IT'S Westinghouse

Steam Headquarters

WESTINGHOUSE

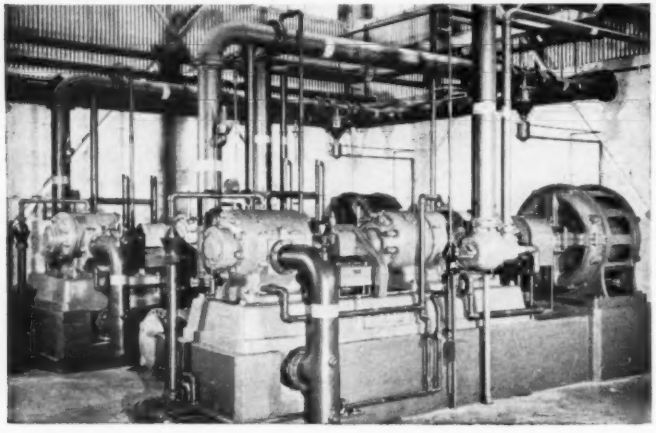


BOILER-CONTROL PANEL mounts recording and integrating flowmeters (two for steam and one for gas), two 3-point draft gages, other instruments and controls



FEEDWATER-TREATMENT system consists of a double-unit softening installation. For internal treatment there is a phosphate feeder and automatic lime-soda treater

COMPRESSED AIR comes from two 2-stage rotary air compressors driven by 350-hp 600-rpm synchronous motors. Two receivers, 54 in. dia, 14 ft high, are not shown



POWER FOR PACIFIC COAST STEEL

(Continued from page 95)

sists of two 4-drum boilers, each rated at a continuous output of 58,000 lb per hr of saturated steam. Designed for 200 psig, these units will supply steam at 175 psig for various process uses in the mill. Three combination gas-and-oil burners fire each boiler. Normal fuel is gas; steam-atomizing oil burners and fuel-oil heating and pumping equipment are provided for emergency operation. Efficiency is 75% on gas and 82% on oil.

Boiler Auxiliaries. Steam turbines with built-in gear units drive the induced-draft fans, which discharge into self-supporting steel stacks. Centrifugal boiler-feed pumps also have direct-connected steam drives. Each pump can supply both boilers at full capacity. Exhaust from these auxiliaries, supplemented by live steam, heats feedwater. A double-unit zeolite softening installation, automatic in operation, conditions the feedwater, with a phosphate feeder and automatic lime-soda treater for internal treatment. A concrete underground tank receives continuous blowdown.

Automatic combustion control regulates fuel-air ratio on 100% gas or 100% oil. The complement of boiler instruments includes electric recording and integrating meters, two for steam flow and one for gas flow, two 3-point draft gages, the usual thermometers, pressure gages, controls.

Compressed Air. To supply the mill's compressed air, two 2-stage rotary compressors driven by 350-hp 600-rpm 2300-v synchronous motors are installed. Aftercoolers have corrosion-resistant tubes and tube sheets, and incorporate moisture traps and oil separators. Each compressor is equipped with inlet-air filter and silencer units. Complete full-magnetic electrical-control equipment has been provided for the compressors, each of the two sets being mounted in dead-front totally enclosed panels.

The emergency fuel-oil system consists of two motor-driven gear pumps, each rated at 10 gpm and 100 psig, a horizontal duplex steam-driven pump, good for 27 gpm at 100 psig, and two steam heaters. Fuel oil is stored underground in a 15,000-gal tank.

"Give us the tools . . ."

For High Wages, Full Employment . . . Business Must Have Better Tools *and More Money to Pay for Them*

So far we have escaped the post-war depression predicted by leading government economists. How can we continue to frustrate gloomy prophets who see only depression ahead?

At the end of World War II the federal Director of Reconversion saw depression immediately ahead. He said we would have 6,000,000 unemployed four months after VJ-Day and 8,000,000 a few months later.

But we did not have depression. We did not because:

First, the American business man, sensing the obligations of a vastly more important post-war America, went ahead to build his plant and equipment to meet expanding domestic and world markets—markets bigger actually and potentially, in terms of world-wide trade and profits than any previously envisaged.

Second, the American businessman was able to get the money to go ahead. Since 1945 he has spent $50 billion building new plants and buying new equipment.

There may be other reasons why we missed a depression in 1946. But—make no mistake about it—what has powered our present prosperity is the $50 billion spent by businessmen since VJ-Day to improve their plants.

It provided jobs directly for 5 million people. It paid for more than half of our record-breaking steel output. It put in place the foundations of great new industries such as television. It strengthened the foundations of the chemical, machinery, plastics, steel and oil industries. It has expanded and improved our power systems throughout the country.

This spending has made the difference between prosperity and slump, between industrial strength and serious deterioration.

In fact, we know now that what business spends for new plants and new tools always makes the difference between prosperity and slump, the difference between national strength and weakness.

The accompanying chart tells the story. When we have spent heavily for new plants and equipment, we have had prosperity and strength. When we have not, we have been in trouble.

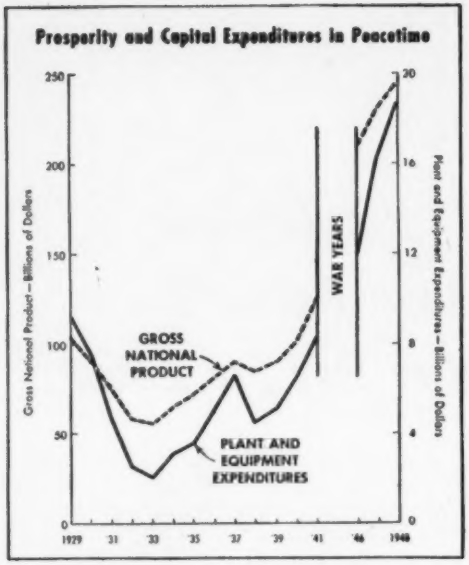
We would have been in trouble since VJ-Day except that business used its war reserves, plus two-thirds of its profits, plus borrowed money to improve and expand its facilities. This year industry is spending $19 billion this way.

Has this great post-war expansion actually made our economy a "mature economy"? Have we come now to the saturation point the New Dealers mistakenly said we had reached in the '30's?

The answer is no!

Proof of that answer is being developed through a McGraw-Hill national survey of "Business' Needs for New Plants and Equip-

continued on next page



ment" details of which will be given in this editorial series in coming months.

We have a bigger nation, more people, to serve right here at home. Further we must meet human needs which the war created around the world. Also, we must sustain a world position such as this country never assumed before.

Here are immediate things crying to be done.

1. Business still needs billions to expand production because our country and our needs are growing rapidly. Example: To meet the demand for power, electric utility companies must nearly double their present generating capacity in 10 years. That will cost more than $7.5 billion. To fill increasing needs for oil and gasoline, oil companies must spend at least as much.

2. Business still needs billions to get its plants up to date and overcome wear and tear. Examples: Over half a million of our freight cars, a third of the total, are more than a quarter of a century old. About two-thirds of the looms in the textile industry are more than 20 years old. Half of our coke ovens, basic equipment for iron and steel production, are more than 20 years old, and only half as efficient as modern ovens.

3. Business still needs many billions to do new things in dramatic new ways. Example: Machinery that will cut out 80% of the dirty, dangerous work of mining soft coal has been perfected. A new automobile engine plant will reduce the work that goes into engine-building by three-quarters.

Hundreds of similar things that our scientists and engineers have developed could be cited. They can be found in every industry. They hold immeasurable promise of adding to the abundance of American living. In fact, there is hardly a step along the whole route of industry – from roughing out raw materials to delivering finished goods – where there are not new and better ways of doing things standing ready for general use.

But the crucial question now is: Where is the money coming from to put to work these new and better ways of doing things?

Business has used its own resources so far... profits and reserves. The stock market, where industry traditionally has raised money from people willing to risk their savings, has been limping along, giving business no chance to get enough money on satisfactory terms. *Business now must look primarily to its own earnings for the money to carry out the improvements which are necessary if America is to keep itself strong and efficient.* The next editorial in this series will deal with this new and crucially-important role of profits.

But business can not count on profits alone to do the job. Profits are too uncertain.

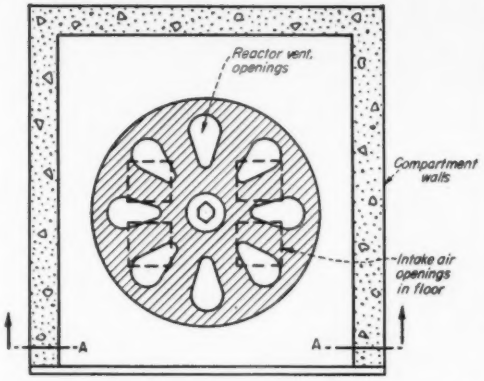
From now on finding the money... to put new ideas and new equipment to work... to go ahead with the expansion and improvement that will thwart depression and build industrial strength ... *calls for the support of all Americans everywhere.*

This comes right down to *you... for at stake is your chance for steady work, for better pay, for new things like television, and for more of the every-day things, like coal and clothing, of better quality and at less cost.*

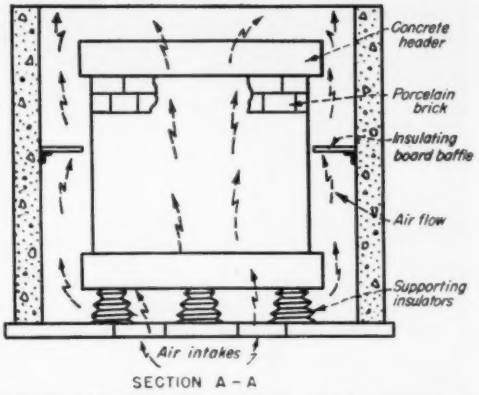
By helping business get new and better tools, you will help yourself – and you will help build a more sound, more prosperous, better America.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.



TOP VIEW of air core reactor. Overheating resulted when 70% of reactor cooling air swept around rather than through unit



OVERHEATING STOPPED when baffle installed on concrete wall increased air circulation through reactor core from 30 to 75%

Are Your Reactors Overheating?

Give thought to reactor cooling when electrical load is increased. K B Hoffman, New York City, kept old reactor in service, stopped overheating by installing air baffle

▶ CURRENT-LIMITING REACTOR consists of a stranded cable, wound in the form of a coil and held in position by supports. It has a wide application although its main use in the power field is to limit the current that flows through a circuit when a short circuit occurs. In addition, transformers with unequal impedances may be paralleled, using reactors to equalize transformer reactance, eliminating circulating currents between both transformers. Another common use for reactors is to limit the starting current of ac motors.

We came across a few ancient current-limiting reactors, designed to limit short-circuit current in a large generator. They were installed in individual concrete compartments, whose floor was provided with grilled openings for ventilating-air intake. Reactors had an air core with a concrete header at top and bottom and were mounted on supporting insulators. Porcelain brick encased the entire coil from top to bottom. To ventilate reactors, the concrete headers were provided with clover-leaf vent openings. The ventilating air entered through the bottom header and discharged through the top. To meet present-day load demands, it was hoped to operate the generator at maximum rating. Tests on the turbine showed it practicable to generate the additional load.

Reactor Limits. The manufacturer limited the reactors to a maximum temperature of 105 C on the conductor. This represented a 65-C rise above an ambient temperature of 40-C. When the generator was operated at maximum rating the odor of insulation drifted from the reactor compartments, and thermometer readings showed conductor temperature 130-C.

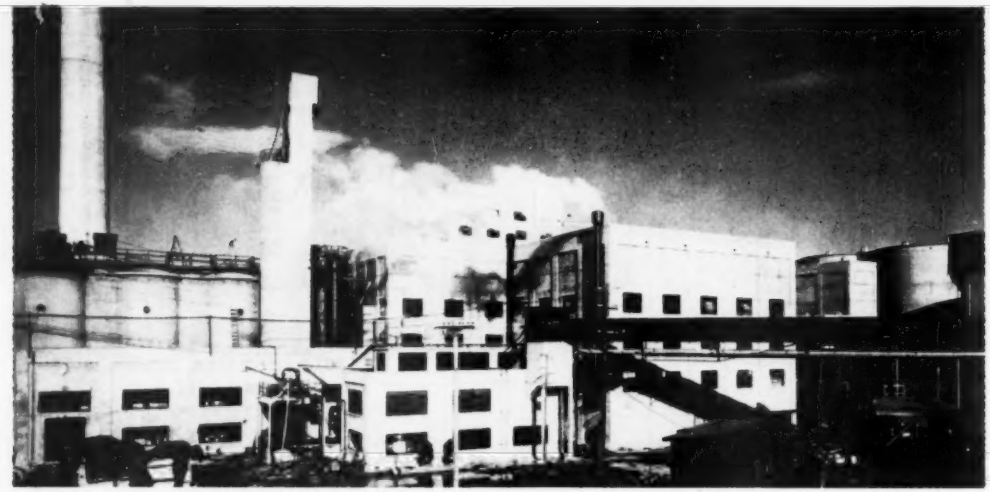
Here, it would be impracticable and costly to increase the air intake with a supplementary blower. Calculations showed that sufficient air was being supplied to reactor compartment to keep temperature within manufacturer's allowable value, even at the higher ampere load. The only explanation we could give for the abnormal temperature on test was that air was not getting to right spots for good cooling.

An air survey, using an anemometer was made of the entire compartment area at reactor top. Air flow through the clover-leaf openings in the header was also measured. Readings showed that 70% of the air flowed around reactor, while only 30% swept reactor conductors.

Baffle Board. To restrict air flow around the reactor, an insulating-board baffle was installed between reactor and compartment walls. Baffle was supported by clip angles to the wall about midway between the concrete headers.

Edges of baffle were rounded to reduce electrostatic stresses at the sharp edges. A clearance was left between the reactor and the baffle to allow air flow to cool the brick surfaces as well as furnish an air insulation to ground. Calculations indicated that the baffle was safe dielectrically since the reactor conductors were insulated with asbestos, mounted in ebony asbestos supports and shielded by porcelain brick. Dielectric tests on the cable conductors verified our calculations.

Air-flow tests indicated that with baffle installed, only 25% of the air flowed around reactor, while 75% became effective cooling air in the reactor. Temperature rise of conductors was reduced to a safe value for maximum generator loading.



RECOVERY BOILERS AND POWER EQUIPMENT for revamped sulphite mill and new sulphate mill are grouped as shown above

New System Recovers Sulphite-Process

Weyerhaeuser Timber Co's Longview pulp mill uses magnesium-bisulphite cooking liquor; new recovery boilers burn waste liquor to reclaim magnesium oxide and SO_2, eliminate disposal problem and furnish major part of mill's steam requirements

► SINCE THE ADVENT of recovery boilers in the sulphate-pulp industry some 20 years ago, makers of sulphite pulp have looked at their cousins with envy. These processes, which make different types of paper pulp from different woods, cook wood chips with chemicals to separate lignin from cellulose. The latter is the raw material from which pulp and, eventually, paper is made. In both cases, spent cooking liquor containing lignin comes from the digesters as a waste product. But in the sulphate process, recovery units burn this material to produce steam and salvage chemicals that can be reactivated for cooking. Until recently, sulphite-process liquor represented only a disposal problem instead of a valuable source of steam and chemicals. The lignin could be burned, but separation of desired chemicals did not result.

New Recovery Units. Two B & W recovery units, which have just gone into operation at Longview plant of Weyerhaeuser Timber Co, solve the problem with magnesium oxide as the base for cooking liquor, instead of the usual calcium oxide. Their output, plus that of a sulphate-process recovery boiler now being installed, will supply most of the steam for process and power generation in the revamped 275-ton sulphite mill and the new 200-ton sulphate mill. They will eliminate stream pollution while recovering most of the chemicals used for cooking.

George H Tomlinson, vice-president of Howard Smith Paper Mills, Ltd, discovered about ten years ago that, of all possible bases for sulphite acid, magnesium is unique in these respects. He found that when a magnesium-oxide-base waste sulphite liquor burns under certain specific conditions, sulphur dioxide is liberated, and the ash produced contains highly reactive MgO free from magnesium sulphide. The SO_2 can then be absorbed in a slurry of the recovered MgO, making magnesium monosulphite, which, when fortified with SO_2 and a small amount of MgO added to make up the small losses in the system, serves again as cooking liquor.

Laboratory investigations showed results promising enough to justify installation, in 1937, of a pilot plant at the Cornwall, Ontario mill of Howard Smith Paper Mills, Ltd, as part of a joint development program of Babcock & Wilcox Co and that company, results of which were announced in 1940. Meanwhile, Weyerhaeuser Timber Co had built and operated a pilot plant at their Longview, Wash. plant, under the Pulp Division Research Dept directed by R S Hatch. One commercial digester operated about a year with magnesium-base acid, recovery being obtained in a pilot-plant furnace.

Common objectives of the companies involved led to collaboration and a decision to install the first full-scale commercial unit at Longview. This operation spreads over 600 acres where the Columbia River takes its last big bend toward the sea, 50 miles away. Here a large sawmill, plywood plant, bark products plant, sulphite-pulp mill and sulphate-pulp mill are integrated to use all grades and types of logs grown on Weyerhaeuser's St. Helens tree farm.

War and its shortages delayed the new mill's schedule so construction did not begin until 1946. Equipment for the MgO recovery system is located between the modernized sulphite mill and a new 200-ton bleached sulphate, or kraft, mill, which will operate soon. Sulphite furnaces are conveniently located

STEPS IN THE NEW PROCESS

1 In digesters, wood chips are cooked with magnesium bisulphite to make pulp. The digesters are dumped and the waste liquor, carrying lignin from the wood, is separated from the pulp

2 Multiple-effect evaporators concentrate the liquor to 50-55% solids before further concentration in a hot-gas evaporator

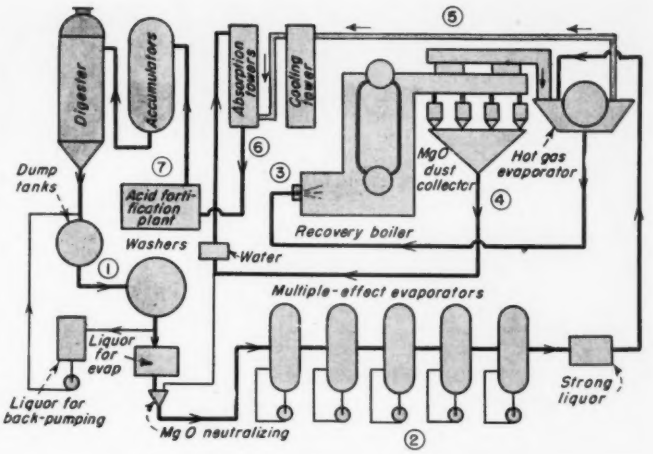
3 Lignin in liquor burns in recovery boiler; flue gas contains magnesium oxide as flyash, sulphur dioxide as a gas

4 Cyclones separate MgO ash from gas containing SO_2

5 Part of heat in flue gas concentrates incoming liquor hot-gas evaporator; part of remaining heat is removed in a cooling tower

6 Made into a slurry with water, recovered MgO dust reacts with SO_2 in absorption towers

7 Resulting magnesium mono-sulphite is fortified with SO_2 to make up losses in the system and is then ready for reuse in digesters



Chemicals, Makes Steam While Doing It

in the same building with the kraft recovery furnace; evaporators for the two mills are grouped and common power-generating equipment is employed (see photo above). This permits maintenance of a single recovery and power-plant department serving both pulp mills. Slab wood and trim formerly used as hogged fuel in power boilers of the original sulphite mill is no longer needed because of the generation in the MgO plant. This wood is now utilized as raw material for the new sulphate mill.

Operating Cycle. The way steam and power are obtained from waste liquor in the MgO process is best understood by looking more closely at the over-all operating cycle. The highly simplified diagram above shows major steps, which are summarized in the legend, at left. In more detail, the process goes thus:

In the digesters, wood chips are cooked under steam pressure (about 135 psi) with sulphite acid having a magnesium base. This separates the wood into its two major components—cellulose and lignin. When suitably refined and bleached, the cellulose forms the mill's product—pulp for papermaking. The digesters are dumped at atmospheric pressure instead of being blown, as is usual. The somewhat longer time required to come down to atmospheric pressure for dumping requires an additional digester, but no increase in cooking time is necessary and it appears likely it will prove less. The pulp and the spent liquor are separated in the washers. After this separation, waste liquor is about 12 to 14% solids.

Before it can be burned, this liquor must be concentrated. Multiple-effect evaporation does the job, bringing it up to 50-55% solids. Six-body quintuple-effect evaporators having submerged tubes are used. Of forced-circulation design, these units produce 4.58 lb of evaporation per lb of steam. Final concentration takes place in a hot-gas evaporator, with flue gas from the recovery boiler furnishing the heat. Before entering the evaporators, waste liquor is neutralized with recovered MgO to prevent loss of any SO_2 during evaporation.

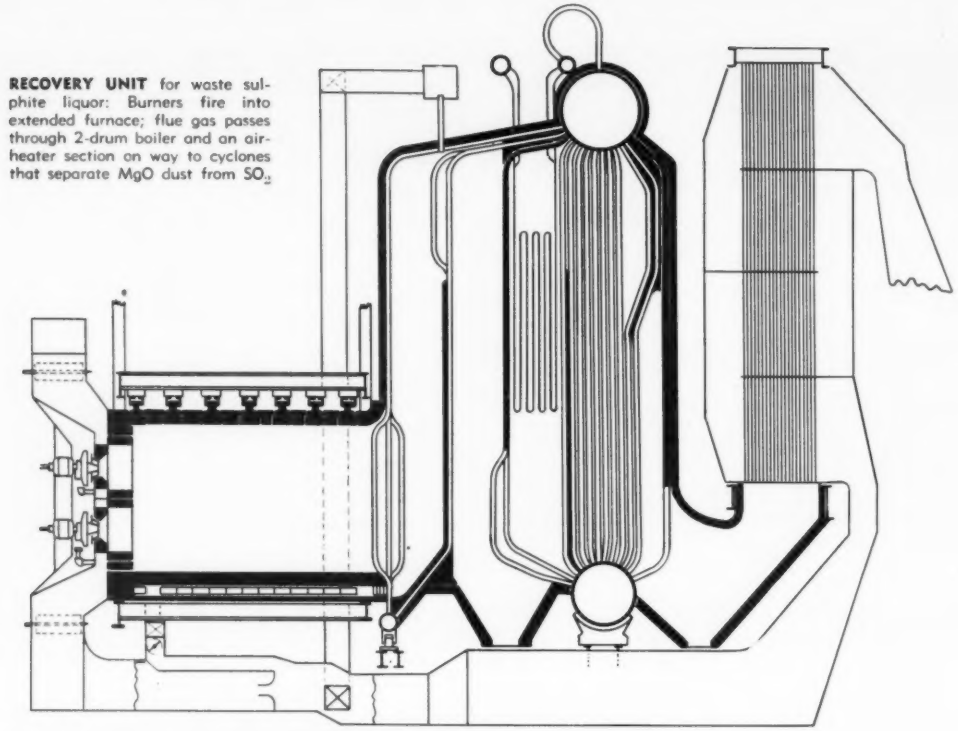
Concentrated liquor goes to recovery-unit burners, designed to handle either liquor or oil. Lignin burns in the boiler furnace, releasing heat needed to generate steam. Resulting flue gas contains MgO, as flyash, and SO_2 as a gas. Carried out of the furnace in suspension, the highly reactive MgO dust is separated in multiple cyclone units.

Made into a slurry with water, the recovered MgO is brought into contact with SO_2 in the flue gas in a series of absorption towers. Before entering these towers, flue gas has been cooled by passage through the hot-gas evaporator and through steel brick-lined cooling towers. In the absorption towers, MgO slurry feeds down, countercurrent to the rising flue gas carrying the SO_2. Combination of MgO and SO_2 produces the magnesium bisulphite used as cooking acid. A special acid-fortification plant produces SO_2 to make up for losses in the system and to keep strength of acid at proper level.

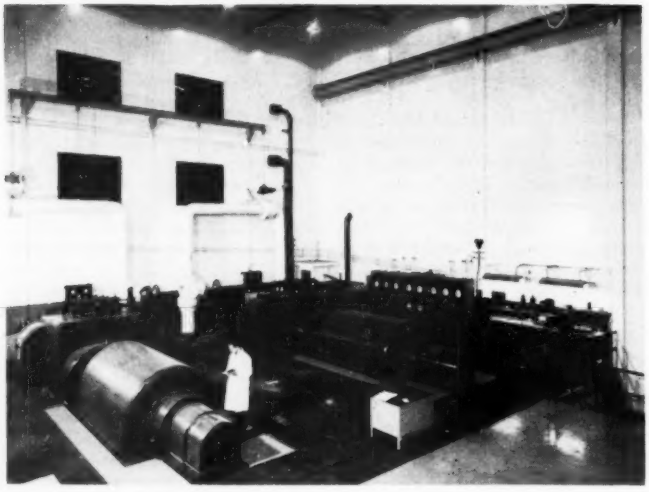
Returning the acid to accumulators for final use in the digesters completes the cycle. Instead of having to dispose of a ton of "waste" liquor for every ton of pulp made, each ton yields about 12,000 lb of steam and most of the cooking chemicals are recovered. Greater solubility of the magnesium compounds is expected to yield superior pulp.

Recovery boilers, heart of the new process, are 2-drum Stirling units with an extended furnace into which the waste liquor is atomized. Furnace temperature and gas velocity are adjusted to yield a dry ash of desired purity and reactivity. Flue gas passes first through an air heater and then through the hot-gas evaporator, where it gives up heat to further concentrate the liquor on its way to the burners. Each sulphite boiler produces 69,600 lb per hr at 615 psi and 700 F.

Common Power Plant. In addition to these units, the common power plant for the two mills houses a sulphate-



RECOVERY UNIT for waste sulphite liquor: Burners fire into extended furnace; flue gas passes through 2-drum boiler and an air-heater section on way to cyclones that separate MgO dust from SO_2



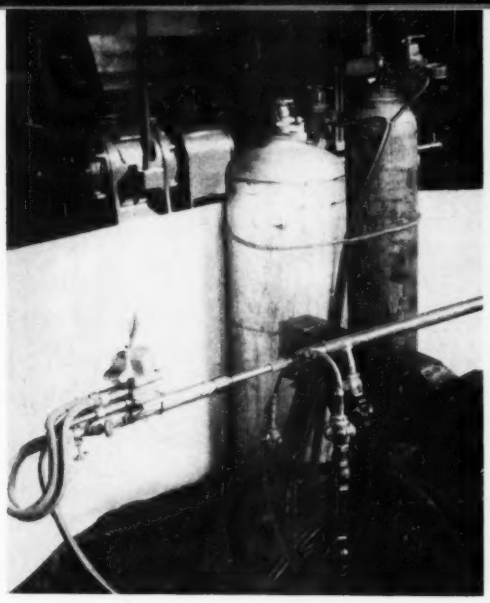
SPACIOUS TURBINE ROOM contains two 6250-kva extraction-backpressure machines supplying steam at 135 psi for digesters and exhausting at 35 psi for other uses

recovery boiler rated at 101,200 lb per hr. Having a vertical furnace, this unit stands seven floors high in contrast to the 3-floor height of the sulphite boilers. Auxiliary heating surface consists of an economizer but, as in the sulphite unit, last step is a hot-gas evaporator.

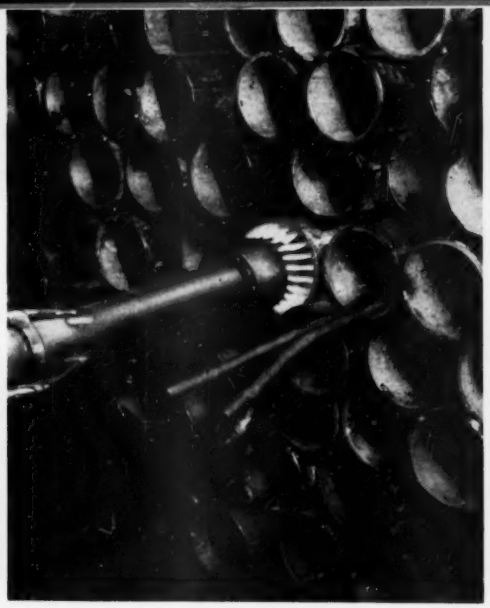
Steam from the three recovery units supplies two 6250-kva turbine-generators in an adjoining room. These bleed at 135 psi to supply digesters and other high-pressure uses, and exhaust at 35 psi, steam at this pressure going mainly to the drying section of the pulp machine and to the liquor evaporators. A pressure-reducing and desuperheating station connects the two pressure levels. Electricity at 13.8 kv is distributed to 10 outdoor substations convenient to various load centers in both sulphate and sulphite mills. At these points, transformers drop voltage to 2,300, 550, 220 and 110. Transmission from power house to substations is by self-supporting aerial cable.

With installation of the new 13.8-kv distribution system, the former 2300-v feeder supplying the sulphite mill from the sawmill power plant has been abandoned. The two power stations are now interconnected at high voltage. On the steam side, the two pulp-mill turbines tie in with the three sawmill machines at the 135-psi level.

This article is based on information secured through the cooperation of Weyerhaeuser Timber Co; Otto C Schoenwerk, consulting engineer, Chicago, who headed plant design and engineering of equipment; and Babcock & Wilcox Co, exclusive licensing agent for the related patents held by the interested companies. This cyclic sulphite-recovery process will be made available to industry by licensing under these patents on terms best adapted to widespread use of the process.



1 Blowpipe and mixer with quick-acting valve supplies gas to the head. Cooling-water and air connections at right



2 Gas orifices shoot flame out in a spiral so it contacts tube surface uniformly. Air orifices are just behind head

Flame Peeling Removes Mill Scale

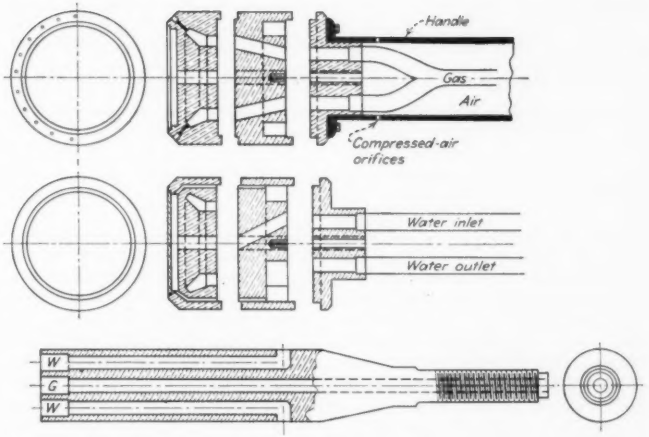
Short application of hot flame cleans boiler tubes quickly before installation. Thus it minimizes localized electrolytic attack from galvanic action when the boiler is in service

By L D ROBSON
Oklahoma Gear Works

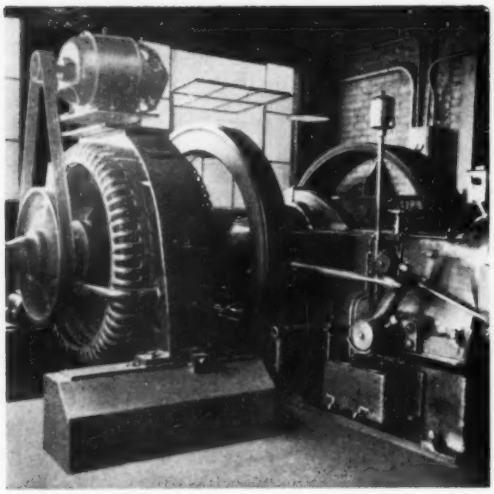
▶ MILL SCALE, a hard, dense oxide film produced in steel manufacture, offers excellent protection against corrosion if coating is continuous. Trouble is that scale is never continuous, and its coefficient of expansion differs from that of steel so coating flakes off in spots.

In a steaming boiler two dissimilar substances (mill scale and steel) are submerged in an electrolyte (boiler water). Result is that galvanic action is set up at the edges of mill scale, which corrodes away the tube metal. Best remedy is to remove all scale.

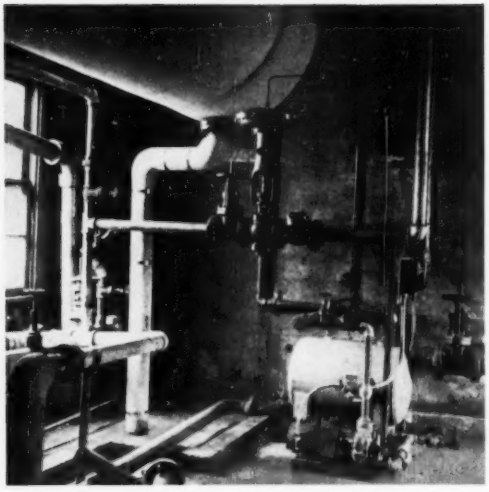
One way to do this is to apply intense heat suddenly and momentarily, which expands and cracks away the mill scale. Heat is applied by the torch described in the photos and sketch as it is passed through each tube at a speed of one ft per sec. It burns oxygen at 25-30 psi and propane at 5.75 psi. To keep torch burning while it is confined within the tube, compressed air at 5-7 psi is fed to the flame through small holes, just back of the head. Flame orifices are No. 67 drill size, positioned at 45-deg angle around the head to produce a spiral effect. Cooling-water spaces, built into the head, are fed by copper tubing carried in the handle.—*Photos courtesy of The Linde Air Products Co.*



3 Water fed through copper tubes keeps head cool. Compressed air flows through chrome-molybdenum handle to keep flame burning when tool is at midpoint in tube



NEW AC GENERATOR, driven by existing Unaflow engine, is operated so exhaust steam produced balances plant's demands



CONDENSATE RECEIVER for improved handling of returns was obtained by reconnecting an existing tank and adding valves

Cost Goes Down, Capacity Goes Up

Removing defects of existing power-service layout in packing plant improves operation with modest investment. A revamped electrical system, ingenious water-heating hookup make maximum use of exhaust to meet increased demand, raise efficiency

By **E H ROPER,** *Consulting Engineer, Toledo, Ohio*

▶ALL TOO MANY OWNERS, and their power engineers, dream of what a new plant could do to boost capacity and cut operating costs, while overlooking the opportunities on their own doorsteps. Often equally attractive possibilities wait only on a careful study of the defects of existing equipment and layout and a thoroughly worked-out program of improvement. The case of a medium-sized packing plant serves as a good example of what can be done.

When I was retained to make a study of the steam, water and electrical needs of this establishment and to recommend changes to reduce cost of these services, the situation was as follows:

Existing Plant. Electrical energy was purchased at 440 v, 3 phases, 60 cycles. A Skinner Unaflow engine, exhausting at 5 psi or less, drove a dc generator to supply part of the motor load. Motors and wiring for this dc system were in sufficiently bad shape to be a hazard and to require high maintenance.

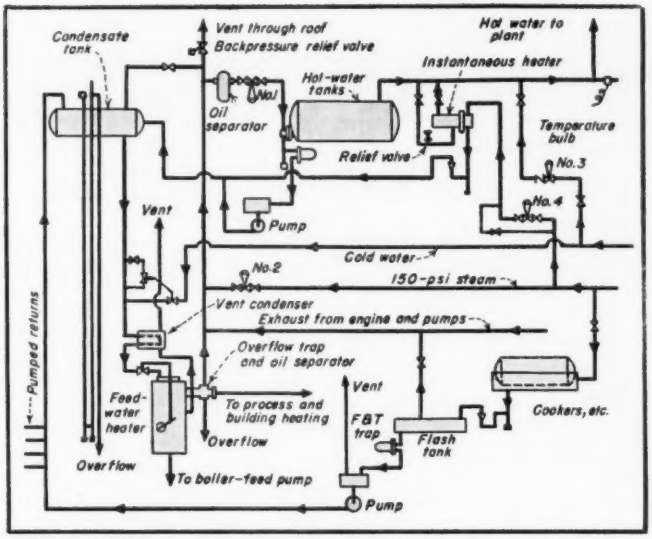
Engine exhaust, plus that from a steam-driven ammonia compressor, went to an open feedwater heater, the building heating system when it was in operation, and a hot-water tank with copper coils. Under these conditions, a considerable part of the exhaust was blown to atmosphere.

The water heater was short of both heating surface and storage capacity. Hot water was used throughout the working day but biggest demand came from 3:00 pm until about 6:30 pm, for washing down the plant and the trucks. To meet the hot-water deficit during this period, live steam was injected into an instantaneous heater and into tees at the hose connections.

Exhaust Wasted. Exhaust pressure varied considerably and in winter it would fall to zero when the high condensing rate of the building-heating system was felt. Several reducing valves fed live steam into the exhaust system but, as they were not very sensitive, pressure would build up and steam escape through the relief valve. Thus live steam was often bled into one part of the system while exhaust was being wasted at the backpressure valve.

Makeup ran about 90%; the only condensate recovered was that in the open feedwater heater and in a part of the heating system. Some connections to the heating system had no oil separators but as these returns went to the sewer, this did little harm. Steam demands during the period of greatest water use exceeded boiler capacity.

The Remedy. First step in the improvement program was replacement of the entire dc system and installation of a new ac generator driven by the Skinner Unaflow engine. Installing double-throw switches on all motor circuits served by the new generator made it possible to adjust current generated to balance exhaust steam produced with amount that the plant could absorb. It also made it possible to generate electricity to the unit's maximum capacity during periods of peak usage, thus sub-



WATER-HEATING SYSTEM now meets all demands, makes maximum use of exhaust

stantially reducing demand charges on purchased energy.

As a second major step, the water-heating and condensate-return system was completely revamped; the diagram shows the new arrangement. Three 1500-gal hot-water storage tanks, each equipped with 400 sq ft of copper U-tube coils, were purchased. The open feedwater heater was equipped with a new vent condenser and an existing tank was put into service for condensate.

Makeup Control. A valve operated by a float in the feed heater allows condensate to flow from the receiver as required by the heater. A makeup valve feeds cold water to the feed heater just above the vent condenser. This valve and float could have been installed to introduce the cold water into the condensate receiver. Adding cold water to the warm water in this tank would, however, have released oxygen and other corrosive gases dissolved in this water. Attack on the tank and piping between tank and vent condenser would have been rapid. Vent condenser has a cast-iron shell and tinned-copper tubes; pipe between vent condenser and heater is extra-heavy wrought iron.

Installing a vacuum pump to serve part of the heating system at a distance from the engine permitted a reduction in pipe sizes. New condensate pumps handle the balance of the system.

Because steam at the exhaust pressure—5 psi, for example—must always be available for building heating, process use and feedwater deaeration, a sensitive pressure-reducing valve was necessary. If, however, steam at 5 psi were always available at the three water heaters, they would soon reach their maximum temperature and would not be available for absorbing surplus steam produced by the engines. This would satisfy the hot-water demand but would waste exhaust steam.

A system of valves and controls was installed to produce the desired operating condition: (1) Low-pressure steam must be available at all times for building heating and other uses. (2) Hot-water tanks must absorb only surplus exhaust steam and act as heat accumulators. (3) Hot water must be available at all times.

Water-Heating System. When steam is available from the engine at 3 psi or more, valve No. 1 (see diagram) remains open and throttles steam passing to the water heaters to maintain this pressure. If amount of exhaust available exceeds capacity of heaters to absorb it, backpressure valve opens and relieves steam to atmosphere. Should pressure drop below 3 psi, valve No. 1 closes and valve No. 2 opens to admit live steam to the low-pressure system to maintain desired pressure. This system regulates within 0.25 psi above and below the set point except when the relief valve must function as described above. The tanks at times reach 226 F.

Various vats and jacketed kettles in the plant are now equipped with the proper traps for use of exhaust instead of live steam. This was not practicable until a constant supply of low-pressure steam was available.

The plant uses water at 180 F. Cold water is admitted through valve No. 3 to produce this temperature. As water in the tanks drops in temperature, valve No. 3 closes and if it falls below 180 F, live steam is admitted to the instantaneous heater through valve No. 4.

Since hot water is always available, live steam except in the instantaneous heater has been eliminated and all condensate for this use is returned to the boiler. By allowing tanks to reach 226 F instead of limiting them to 180 F, storage capacity is increased considerably.

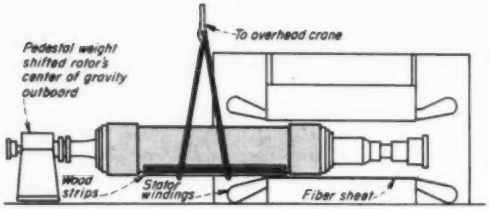
Control system for these valves incorporates gages, which indicate loading pressure on the diaphragms, and thus show the engineer whether they are open or closed. By referring to these gages, he can determine amount of load to place on the generator.

High-Pressure Returns. Some equipment in the plant cannot be operated with low-pressure steam, and live steam is used in the jackets. Naturally there would be considerable flash steam from the discharge of the bucket traps serving these jackets. By reference to the diagram it will be noted that high-pressure trap discharges are piped through flash tanks consisting of about 5 ft of 6-in. pipe. Flash steam is vented to the exhaust system. Condensate from flash tanks discharges through float-and-thermostatic traps to a condensate tank.

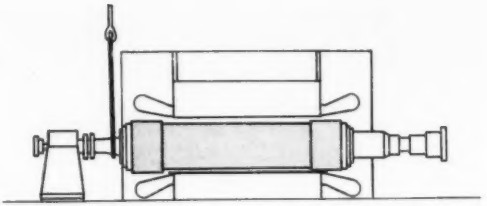
Results. Sufficient metering equipment is not available to determine exact amount of savings produced by these changes. In spite of the fact that there has been an increase in business activity and two additional buildings are being heated, savings in coal, water-treating chemicals and electrical energy have been made. Boiler peak loads have been reduced considerably. Thus a soundly worked out program of improvement has boosted effective capacity and cut operating costs with a relatively modest investment.

PRINCIPAL NEW EQUIPMENT

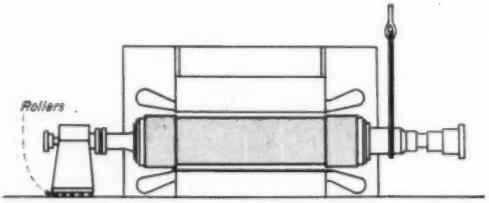
Steam, water valves (air-operated); air-powered regulators
Mason-Neilan Regulator Co
Water heaters.....Patterson-Kelley Co
Vent condenser.....The Swartwout Co
Float boxes and valves..Davis Regulator Co
Float-and-thermostatic traps
Warren Webster & Co
Bucket traps.....Armstrong Machine Works
Condensate pumps and vacuum pumps
C A Dunham Co
Oil separators.....Cochrane Corp
Insulation.....Owens-Corning Fiberglas Corp
Generator, exciter.....Elliott Co
Voltage regulator..Burlington Instrument Co
Panelboard.....Trumbull Electric Mfg Co



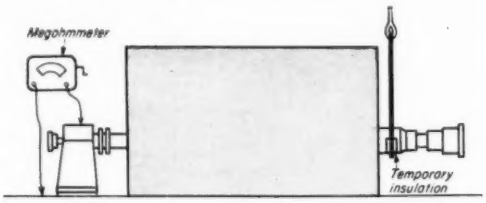
1 Rotor and pedestal carefully balanced by trial lifts from rotor cradle rest before swinging into the position shown



2 With aid of rope tackle, rotor pulled along greased fiber pad on stator bore while the crane supported pedestal end



3 With pedestal supported on rollers, rotor pulled into its normal position by operating crane parallel to rotor axis



4 Insulation between pedestal and soleplate checked with a megohmmeter while crane on turbine end supports shaft

Tips on Installing Generator Rotor

Putting pedestal on shaft before installing rotor reduced number of steps for John Brown, engineer with the Ariguanabo Textile Co, Havana, Cuba; pedestal insulation test outlined

► FOLLOWING THE STEPS above, we installed the rotor and tested pedestal insulation of a 5000-kw turbine-generator. Procedure is straightforward but requires close cooperation between crane operator and engineer directing each movement from floor.

Preliminaries. Before lifting rotor off cradle, we slipped protective ¾-in. wood strips between sling, from overhead crane, and rotor body. After outboard pedestal (one farthest from turbine) was placed on rotor shaft, we made trial lifts and juggled cable sling till rotor balanced when lifted. Putting pedestal in place before lifting rotor allowed us to fasten sling well back of rotor's normal center of gravity. This trick meant we got more of the rotor within stator frame before we had to shift the sling again.

When rotor was balanced and suspended by overhead crane, we slipped a grease-covered fiber pad over lower part of stator windings. Any metal particles that may have clung to the field poles were wiped off before jockeying rotor to position in Fig. 1.

Block and tackle helped pull the rotor in when supported as in Fig. 2. By keeping the rotor level, this move was smooth, aided by the greased fiber pad. When rotor shaft appeared on far side of stator frame, the crane was stopped and rollers slipped under the pedestal. After reslinging rotor on turbine side, Fig. 3, the crane was inched along (in line with the rotor axis) till rotor was in its normal position. Latter move was made after checking that rotor was level.

Pedestal Insulation. With rotor settled in position in stator bore, rollers were removed from beneath pedestal (this required help from crane on outboard side) and insulation slipped in place between pedestal and soleplate. Why insulation? It's accepted practice to insulate one pedestal of ac generators and coupling of direct-connected exciter. This prevents flow of circulating current through shaft, bearings and soleplate. Such current would flow if oil lines, bolts and dowels in one pedestal were not insulated, since a small voltage is being induced in shaft from the dc field. Circulating currents, if allowed to flow, eventually pit both bearings and shaft.

Usually it is difficult to check this insulation once unit is installed since a parallel path is fixed through shaft, rear bearing and soleplate.

Test Method. On this installation we checked pedestal insulation as in Fig. 4. After pedestal was bolted in place, oil line and bearing relay were connected while rotor was supported on turbine end by crane with sling insulated from rotor shaft. In making this test, the rotor was carefully centered within the stator allowing pedestal to carry its normal weight. A megohmmeter connected between pedestal and soleplate quickly told us insulation was OK.

We believe this method of test is more practical and gives a better indication than if we simply assembled the pedestal and measured insulation resistance without having rotor in place on the bearing surface. Measurement taken after connecting the oil lines and bearing relay, while pedestal supported its normal load, gave us an indication of insulation resistance under simulated working conditions.

ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*

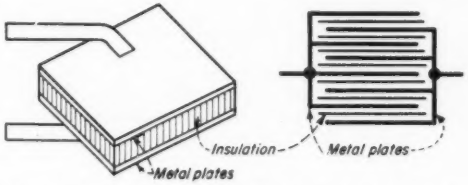
9—Capacitors and Capacitance

► CAPACITORS, sometimes called electrostatic condensers, or just condensers, are among the most generally used devices in electronic circuits. They filter or smooth out peaks in electric-current flow, temporarily maintain voltage, change frequency, act as timers, and help on many other jobs. We need to understand their characteristics as we shall be studying their action under many conditions in future articles.

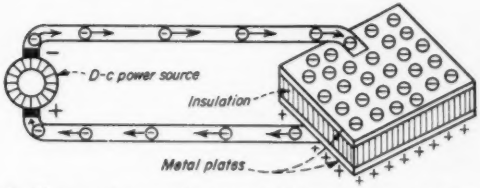
Capacitors. A capacitor is a device for storing electrical energy temporarily. It consists of two or more metal plates separated by insulation (a dielectric), Fig. 1. The plates are good conductors, usually copper, aluminum or tin foil. Insulating material may be air, thin sheets of mica, wax paper, paper soaked in oil, or a special insulating liquid. Area of the plates, the distance between them, and the kind of insulating material determine the energy-storage capacity of a capacitor. To obtain sufficient conductor area, capacitors are generally assembled of many metal-foil plates with a sheet of thin insulating material between each pair. Alternate plates are connected to form insulated groups, Fig. 2, connected to terminal leads and sealed in a metal container.

(*Continued on page* 108)

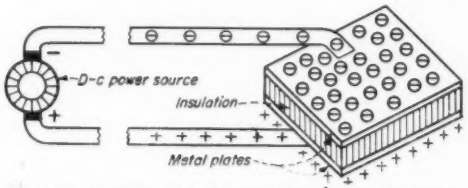
Capacitors and Hydraulic Analogies



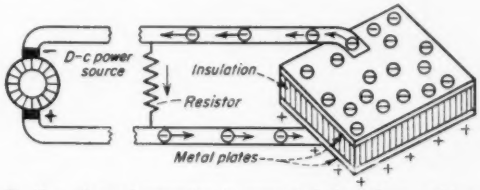
1 Metal plates of capacitor separated by insulation **2** Conventional symbol for a capacitor or a condenser



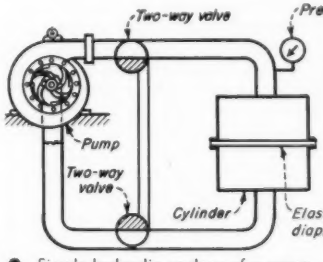
3 Diagram of a capacitor connected to a dc source to show how the electrons flow from one plate to the other plate



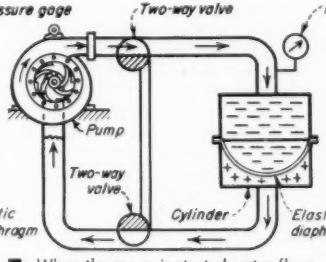
4 When a capacitor is disconnected from its dc source it remains charged unless electrons leak through insulation



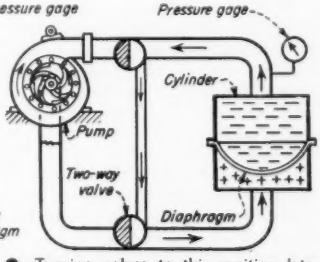
5 If a charged capacitor is connected through a resistor, a current will flow from the — to the + plate, as shown



6 Simple hydraulic analogy of a capacitor connected to its power source

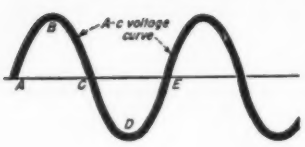


7 When the pump is started water flows from one side of diaphragm to other

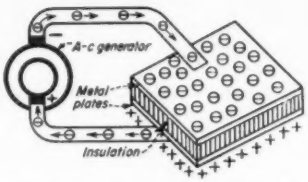


8 Turning valves to this position lets water flow from diaphragm — to + side

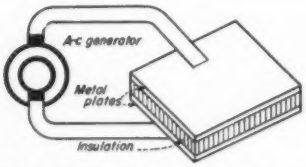
Capacitors on an Ac Circuit



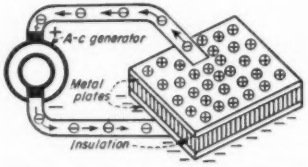
9 Voltage of ac generator continually changes its direction in a circuit



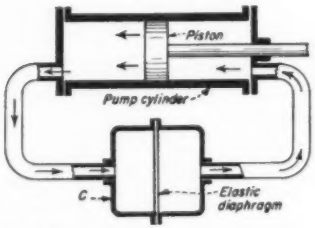
10 How condenser is charged if voltage increases, as from A to B in Fig. 9



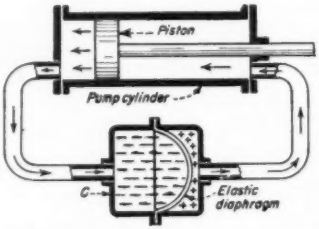
11 When voltage decreases from B to C, Fig. 9, capacitor becomes discharged



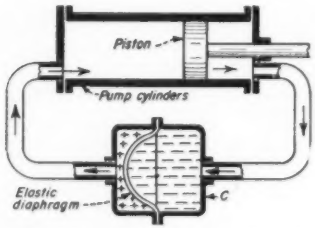
12 From C to D, Fig. 9, capacitor is charged, opposite direction to 10



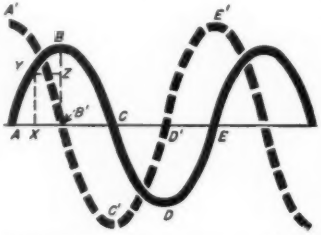
13 Hydraulic analogy shows how a capacitor charges and discharges on ac



14 Moving the piston to left causes flow of water to deflect diaphragm



15 When piston is moved to the right, elastic diaphragm is moved to left



16 Relation of ac voltage to current flow as capacitor charges, discharges

Another construction uses two strips of metal-foil of suitable length, one insulated from the other. These strips with their insulation are formed in a tight roll and the terminal leads connected to the metal strips. The roll is then sealed in metal containers.

Operation Is Simple. When a capacitor is connected across a dc source, Fig. 3, electrons flow from the plate connected to the + terminal of the power source to the opposite plate. That is, there is a current flow from one plate to the other. Because of the electron loss from the plate connected to the +terminal, this plate has a positive charge, that is, it is deficient in electrons. The other plate is given an excess of electrons and is negatively charged, as shown.

Electrons flow from the + to the − plate until the potential between the two equals that of the power source. Incidentally this flow occurs almost the instant the circuit closes, when the capacitor is said to be charged. After it occurs, we may disconnect the capacitor from the power source, Fig. 4, and it will remain charged, unless electrons leak across the insulation or are released by an outside conducting path.

Potential of the charge on the plates, we said, was equal to potential of the power source. Therefore, the electrons try to get from the − to the + plate with a force equal to the potential between the plates. Being prevented from doing this by the insulation the electrons flow back through an external circuit, the resistor, Fig. 5.

Rate at which the capacitor discharges depends on the resistance of the external circuit. If the resistance is low, discharge is almost instantaneous. Through a high resistance, several seconds may be required.

In the preceding article (POWER, Dec, p 129) we learned that inductance was the result of a change in current flow. Stored energy in a capacitor, its capacitance, is due to voltage, electric-pressure change. We have a hydraulic analogy of the capacitor in Fig. 6. Here a cylinder has an elastic diaphragm connected across it, and connected with a centrifugal pump in a closed system filled with water.

When the pump is started it builds up a pressure in the direction of the arrows, Fig. 7, which deflects the diaphragm. The pump caused water to flow from the side of the cylinder marked + and into the side marked −. Note that the water flowing out of the + side is not the water that flowed into the − side of the cylinder.

What happened is: Water moved in the system until tension built up in the diaphragm equal to pump pressure. This is what occurred in Fig. 3. There was a slow drift of electrons in the system from the + to the − plate until the potential across the capacitor equalled generator voltage.

If the valves are turned to the position in Fig. 8, the pump is shut off and the diaphragm gives up its stored energy by causing water to flow from the cylinder's − to its + end, until the diaphragm comes to rest.

We have just seen that when a capacitor is charged on a dc circuit, electron flow into it ceases when its potential equals that of the charging source. In an ac circuit, voltage is continually changing direction, as in Fig. 9—that is, voltage increases from zero at *A* to a maximum at *B*, then back to zero at *C*. It then reverses, increases to a maximum at *D* and returns to zero at *E*, to repeat the cycle again. Therefore, electrons surge back and forth

from one plate to another through the outside circuit. This process is indicated in Fig. 10 to 12.

Fig. 10 shows the conditions when the voltage increases from *A* to *B*, Fig. 9. The capacitor is being charged and at *B* has a full charge at generator potential. As the voltage decreases from *B* to *C* the capacitor discharges, Fig. 11, being fully discharged at *C*, Fig. 9. Here the voltage reverses and from *C* to *D* charges the capacitor in the opposite direction, Fig. 12. From *D* to *E*, Fig. 9, the capacitor again discharges as the voltage decreases.

From this procedure, it is evident that with a capacitor connected to an ac circuit a flow of electrons, an electric current, surges back and forth through the circuit from plate to plate as many times as the voltage changes direction. An ammeter connected in the circuit would indicate the current flow even though there is no flow of electrons through the capacitor's insulation.

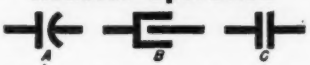
Fig. 13 shows a hydraulic analogy of this effect. Here a reciprocating pump represents the ac generator and replaces the centrifugal pump, Fig. 6. Moving the piston to the left causes water to flow out of the right-hand end of cylinder *C* and into its left-hand end to deflect the diaphragm, as in Fig. 14. This condition corresponds to the charged condenser, in Fig. 10.

On reverse motion the diaphragm gives up its stored energy to assist in moving the piston to its central position, Fig. 13, which corresponds to the capacitor's discharge condition, Fig. 11. Moving the piston to the right causes water to flow from the left-hand end of cylinder *C* into its right-hand end to deflect the diaphragm to the left, Fig. 15. This corresponds to the charged capacitor, Fig. 12.

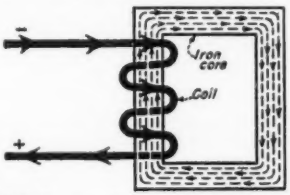
With this setup, as the piston is moved back and forth in the cylinder, water flows first in one direction and then in the other in the system without any being transferred from one end of cylinder *C* to the other. This is similar to the way electrons flow in an ac circuit from one side of a capacitor to the other, without any flow through it.

Rate of current flow into a capacitor is proportional to the rate of voltage change. In Fig. 10, assume that the capacitor is connected to the generator at instant *A*, Fig. 16, which is the beginning of a cycle. At this point, voltage is changing at a maximum rate. Light dotted lines indicate why this is so. In the time *A* to *X*, the voltage increases from *A* to *Y*, which is more than twice as much as from *Y* to *B* in time *YZ*, which equals *AX*.

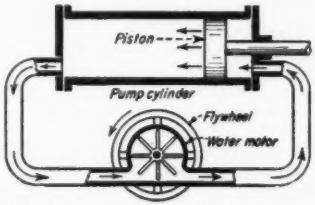
Reactor Operation



17 Three different symbols are used to represent capacitors in the circuits



18 Reactor diagram has a single coil on a 2-legged laminated iron core



19 Hydraulic analogy to show effects of a reactor connected to ac circuit

Since the rate of current flow into a capacitor is proportional to voltage change, maximum rate of flow occurs at *A*, where the voltage is increasing at a maximum rate. This instant is represented by *A′* on the current curves. As the voltage approaches its peak, its rate of change decreases. Therefore, the rate of current flow also decreases, as indicated by the downward slope of the current curve.

When the voltage reaches its maximum at *B* it remains constant for a moment. Consequently, because there is no voltage change, electron flow to the capacitor ceases or is zero at *B′*. As the voltage swings from the positive toward the negative direction its rate of change again reaches maximum as it crosses the zero line. Note the steep slope of the voltage curve at point *C*. But since the voltage is now in a negative direction, current flow will be reversed and reach its maximum at *C′*.

Following the same pattern the negative voltage peak is reached at *D*. Here the voltage remains momentarily constant when the rate of change in current flow at *D′* is zero. As the voltage swings back to positive direction, rate of change in current flow increases to a maximum at *E′*, as the voltage cycle is completed at *E*.

This current wave is shaped like the voltage wave, which is true only because the change in voltage follows a sine curve. But the current wave is displaced from the voltage curve by ¼ cycle, or 90 electrical degrees. In electrical terms, current leads the voltage by 90 deg.

We have already seen that current flow into and out of a capacitor is proportional to the voltage rate of change. Current flow is also proportional to the change in frequency, when the voltage remains constant. That is, doubling the frequency doubles current flow. This is easily understood, because the current flows in and out of the capacitor twice as frequently. In Fig. 13, if the piston makes two strokes per minutes, a given amount of water will flow in and out of cylinder *C*. Increasing the piston speed to four strokes per minute doubles the rate of water flow in and out of the cylinder *C*. Similarly, if the frequency of an ac circuit is doubled, current flow in and out of a capacitor is also doubled.

Capacitance. Amount of charge that can be stored in a capacitor at a given voltage and frequency is called its capacitance. Basic unit of capacitance is the farad. For a capacitor to have one-farad capacitance, current must flow into or out of it at the rate of one ampere when the voltage changes at the rate of one volt per second. Because this would require a very large unit, the microfarad, one millionth of a farad, and the micromicrofarad, one millionth of a microfarad, are commonly used.

Microfarad and micromicrofarad capacitors are the sizes used in electronic devices. In these circuits capacitors are represented by any one of the symbols in Fig. 17, *A* to *C*. In future articles we will use the *A* symbol so it will not conflict with the symbol for a contactor, which is similar to *C*.

Capacitors and reactors are frequently combined in electronic circuits. We have learned that a capacitor stores energy like a distended diaphragm or a compressed spring. In a reactor, Fig. 18, energy is stored in the coil's magnetic field.

While the magnetic field increases in the iron core because of increasing current flow, it induces a voltage in the circuit that opposes the increase in current. When the current and magnetic fields decrease a voltage is induced in the circuit that tends to keep the current flowing. This action is similar to that of a flywheel in a mechanical system.

Fig. 19 shows a hydraulic analogy of

(*Continued on page* 140)

POWER ENGINEERS' NOTEBOOK

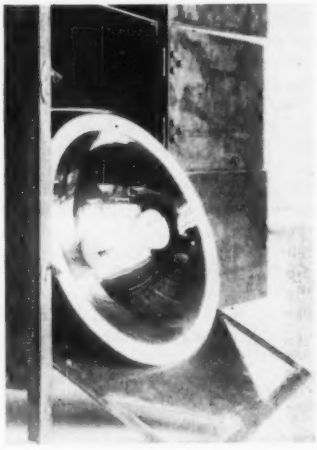
PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

ELECTRIC OVEN SPEEDS EVAPORATION OF WATER SAMPLES

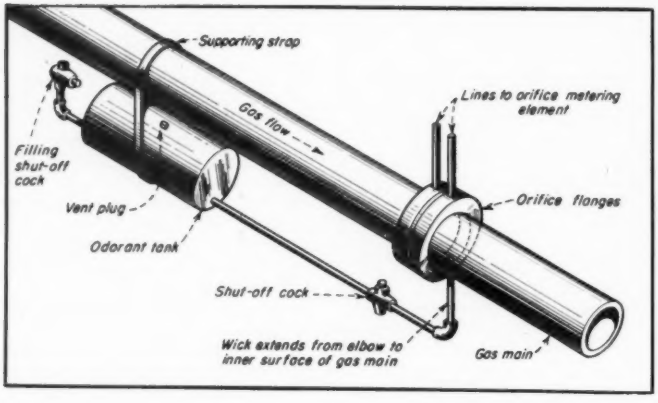
EVAPORATING boiler-water samples to determine total solids is time consuming by the usual water bath. This oven speeds up the process by doing the initial vaporization without spattering, after which the water samples are transferred to the water bath. One-in. angle irons and ⅛-in. steel plates make up the oven. Inside dimensions are 12x12½ in.; shelves are spaced 7½ in. apart for total height of 34 in. from floor to cabinet top.

Small sections of angle iron on the inside walls support the reflectors and heating elements. These are 660-w 110-v radiant-type elements. Openings in the shelve corners provide circulation to carry off the vapor. The water samples are held in shallow soup-plate-type dishes.

E E SMITH *Scranton, Pa.*



ORIFICE FLANGES USED AS POINT OF ODORANT INDUCTION



IN PLANNING to install a gas odorizer on our gas-distribution system we had to consider the fire hazard of sweating joints on our all-copper pipe system. We decided the best point of entry was at a tap in the downstream side of the orifice flanges for the flowmeter on this line.

The odorizer system was our own design and construction, using a wick instead of a bypass arrangement. An odorant supply tank was made of 6-in. pipe with plates welded on each end. Pipe couplings were fitted at the bottom of each end. Toward the top of the cylinder a ⅛-in. hole was drilled and tapped for service as a vent during filling. This tank was hung from the gas main and hooked up to the flange tap, as shown in the sketch. A wick was inserted in the vertical riser to the flange, extending from the lower elbow to the inside surface of the pipe. Pipe size is ½ in.

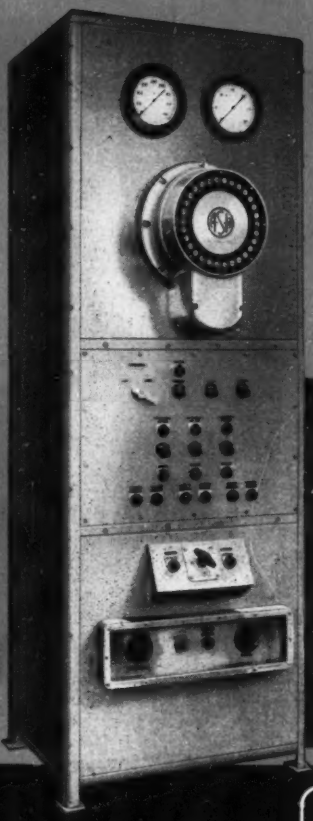
To fill tank, close shutoff cock between tank and main, bleed off pressure at vent; open filler cock and pour in odorant. Shut filling cock, close vent with plug and slowly open shutoff cock. Odorizer is now ready to work. Care must be taken to insert wick properly. Do not allow it to project into pipe, or meter reading may be upset by eddy currents in gas flow.

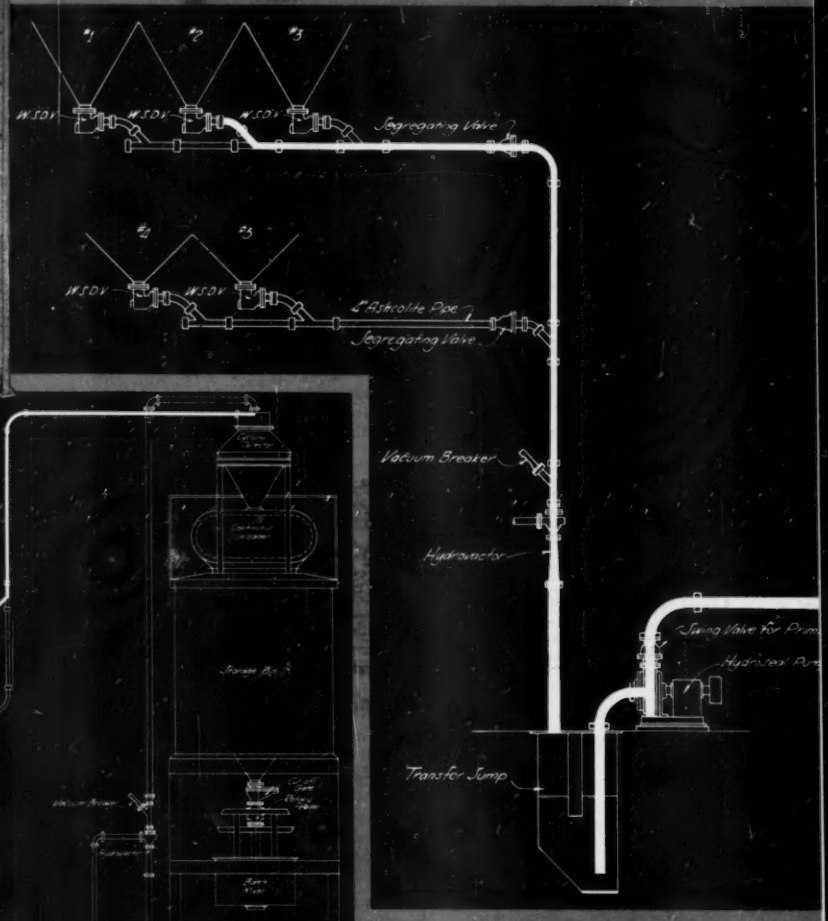
JAMES F MAHER *Shiprock, N. M.*

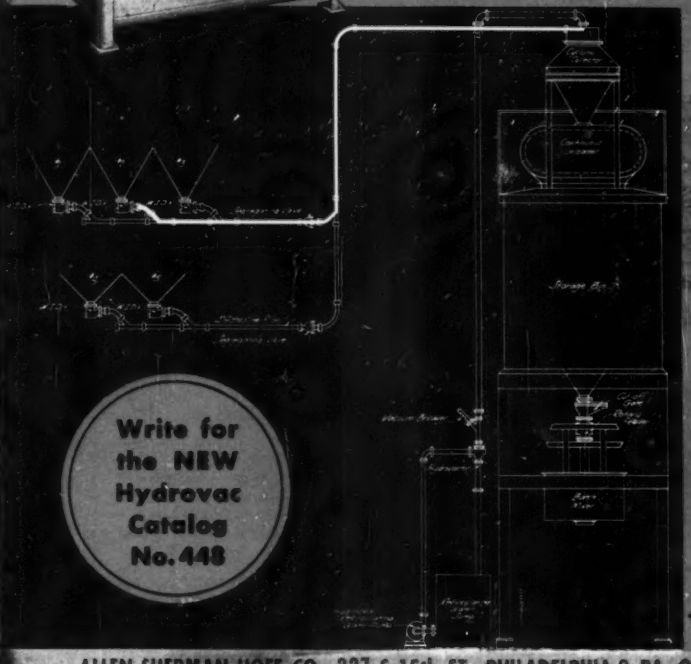
(*Continued on page* 112)

Automatic Dust Handling Not a Luxury For Any Size Plant! It Pays Its Way

Push Button Dust Handling with the Automatic Sequence Hydrovac saves enough in operating time, attendance and maintenance to liquidate its additional cost over a hand operated Hydrovac System in a very short time. Liquid, wetted and dry dust disposal methods, developed by A-S-H, suit every plant condition. May our representative explain what "Automatic Sequence Hydrovac" can DO and SAVE for YOU?





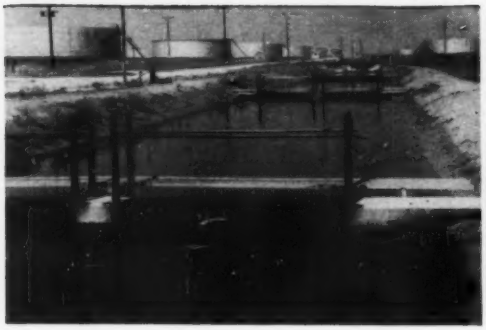


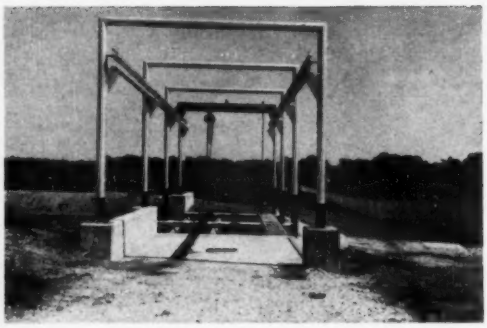
Write for the NEW Hydrovac Catalog No. 448

Above, dust and vacuum producing water discharging into sump, then pumped to distant levelands for fill by A-S-H Hydrovac Ash Pump.

Left, dust collected and stored dry, then periodically fed into A-S-H Automatic Batch Mixer which discharges wetted dust into cars or trucks.

ALLEN-SHERMAN-HOFF CO., 227 S. 15th ST., PHILADELPHIA 2, PA. *Offices & Representatives in Principal Cities*





YARD SKIMMING PIT REMOVES WATERBORNE WASTES

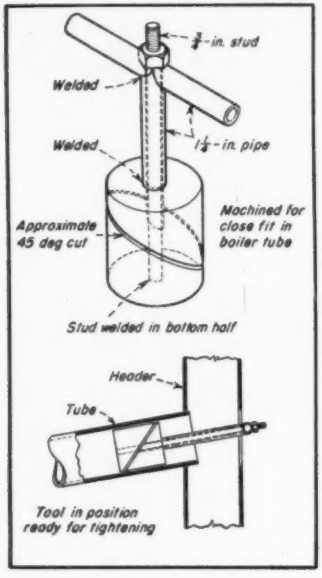
OIL, GREASE AND WATERBORNE WASTES must be removed from drainage water before it reaches open streams, or pollution dangerous to plant and animal life may result. To perform this duty, one oil company developed the system illustrated above, which has proved satisfactory in operation.

Drainage ditch, through which all water must pass, has several baffles in series, forcing the water to flow below the barriers while the surface is skimmed of objectionable matter. Baffles are concrete piers holding two plank sections regulating height of water surface. One set serves as a flood dyke that holds back the water at the surface, the bulk of the water escaping below. Skimming pans are set at each baffle across the ditch. Lowest point of the sloping bottom of these pans connects to a flexible hose leading to the sump pump. In photo, left above, the pans are lifted to show the hose. The skimmings collect in a slop tank where they are purified and separated by heating.

A windlass carries the pans so they may be accurately placed at the upstream edge to intercept the floating matter. Turnbuckles help to adjust leveling pans with water surface.

To catch the oil that escapes the baffles and pans, the drainage water is forced to pass through two sets of three hay tanks in series, upper right. These are boxes with steel sides and bottoms filled with hay, straw or excelsior. The upper 6 to 8 in. of water flows through this packing, which absorbs the oil and grease. A weir controls the water level on the downstream side. Fouled packing is dried and burned. The steel box is burned off with gasoline until all greases and waste are removed. Repacking with filtering material readies it for use.

ELTON STERRETT *Houston, Texas*



HOLDING TOOL SIMPLIFIES TUBE ROLLING

TO DO A GOOD, TIGHT TUBE-ROLLING JOB the work must be held solidly in position. We developed the clamp shown at left for this purpose. It has the advantages of being easy to apply and remove, and of holding the tube exactly in position during rolling.

It is made up of two lengths of 1¼-in. pipe, a long stud and a solid cylinder, machined to enter the boiler tube with a sliding fit. This cylinder is cut in two on a plane about 45 deg from the cylinder axis. The stud is welded into the bottom half. The two pipe sections are welded on the top half, as shown, with the cylinder drilled to allow ample clearance for the stud passing through it when in working position. Equal clearance must be provided in the vertical pipe for the stud.

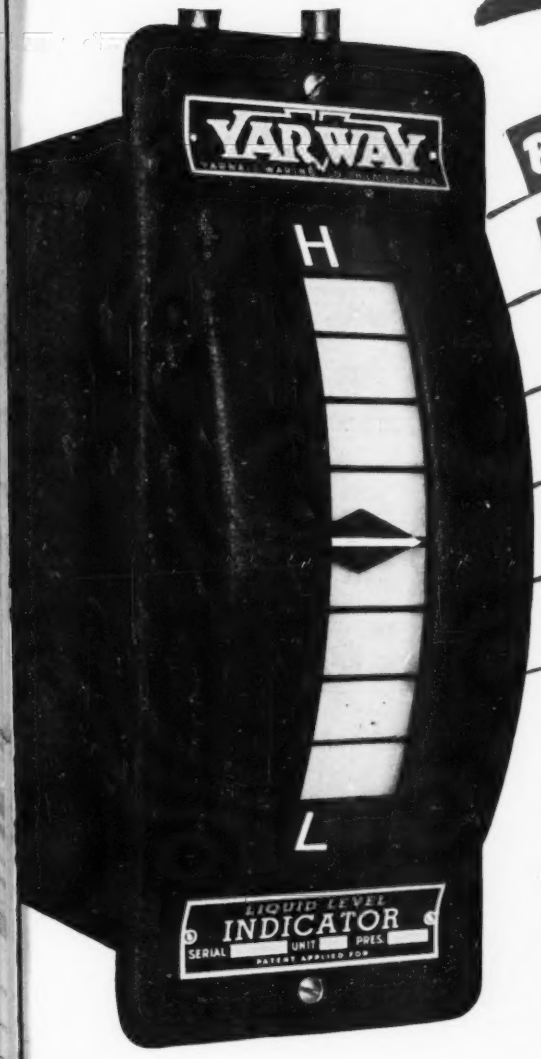
After the tube to be rolled is in position, slide the cylinder inside the tube, through the handhole in the header, until the crosspiece rests on the header. Tighten nut on the stud until the tool has securely clamped the tube in position. As the two halves of the cylinder are fastened together, they slide on the 45-deg surfaces until they are wedged in the tube interior.

E L FAUTH *Quarryville, Pa.*

CONTRIBUTIONS INVITED

POWER pays $20 for each item published in "Power Engineers' Notebook." Here's your opportunity to cash in on those professional tricks you have successfully used in the past, and help your fellow power engineers at the same time. Your manuscript need be in rough form only, giving all facts, with sketches in pencil. We will edit it for publication. This department covers power problems in design, operation and maintenance.

CHECK



BOILER WATER LEVELS at EYE LEVEL

Boiler water level readings are brought right down to eye level—on the instrument panel or any other place in the power plant—with the Yarway Remote Liquid Level Indicator.

Indication is *instant* and *accurate* because indicator is operated by the boiler water itself. Mechanism is never under pressure. There are no stuffing boxes—operation is frictionless. Complete separation of indicating and actuating parts is obtained by permanent magnet transmission.

Yarway Remote Indicators are used not only for boiler water level readings, but also for other liquid levels.

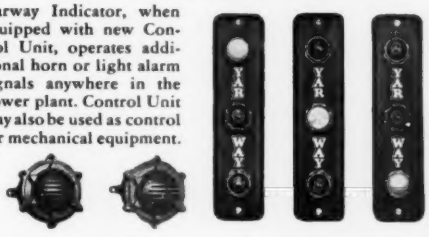
FOR COMPLETE DESCRIPTION WRITE FOR BULLETIN WG-1822

•

YARNALL-WARING COMPANY
100 Mermaid Avenue
Philadelphia 18, Pa.

NEW CONTROL UNIT PROVIDES REMOTE SIGNALLING

Yarway Indicator, when equipped with new Control Unit, operates additional horn or light alarm signals anywhere in the power plant. Control Unit may also be used as control for mechanical equipment.



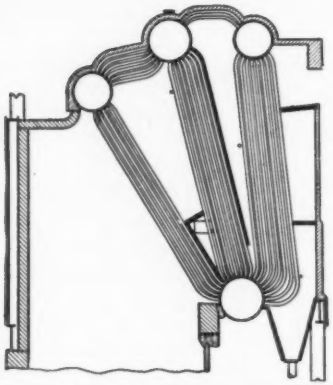
Horn alarms Light alarms

YARWAY REMOTE LIQUID LEVEL INDICATOR

PROBLEMS FROM THE PLANT

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

WHAT CAUSES BOILER TUBES TO PLUG?



WE ARE HAVING tube trouble with one of our oil-fired Stirling boilers, rated at 2870 sq ft. Boiler is 18 tubes wide and 12 deep; all tubes are 3¼ in. in diameter.

Our problem centers around the front row of tubes in the second bank. We found five tubes in this row plugged, holding water when boiler was empty. One tube bowed to extent that end of tube, ordinarily rolled within drum, had pulled to a point where its end was level with inner surface of drum.

An inspector from the company handling our feedwater problem, in addition to the boiler manufacturer's representative, was consulted but we have received no satisfactory answer to date.

Feedwater is checked at least four times each week. Samples have been sent to the feedwater company's home office and water has always been found up to standard. Analysis below is of deposit taken from plugged tube in center bank. I would certainly appreciate getting the thoughts and experiences of other POWER readers on this matter.—*SW*

ANALYSIS OF TUBE DEPOSIT, PERCENT

Sulphur trioxide	14	Iron and alum oxides	3–5
Carbon dioxide	7	Calcium oxides	36
Phosphorus pentoxide	12	Magnesium	5
Silica	16	Net ignition loss	7

Note: There was no evidence of sulphides, while amount of magnetic iron oxide and water soluble material was negligible.

Readers' Answers

How Can We Ventilate Our Plant Cafeteria?

(This question is from Oct issue with best answers from readers.)

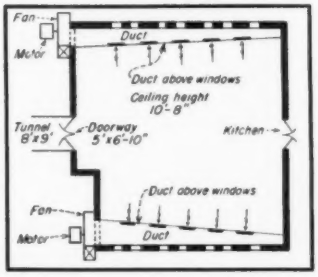
Our cafeteria becomes uncomfortably warm and stuffy when in use during summer months. We plan installing exhaust fans to draw cool air from the basement of our main building through the dining room. Tunnel shown in sketch [see p 138, Oct POWER*] connects to main-building basement.*

Cafeteria seats 225 people during each of the 40-min lunch periods between noon and 2 pm. I think four exhaust fans placed in the end windows, as shown, would provide proper ventilation.

Placing each fan in top sash of corner windows should prevent dead spots at the tunnel end of room. Of course we plan to keep all dining room windows closed when fans are on. We are toying with the idea of how many changes of air constitute good practice.

Perhaps POWER *readers have met this or a similar problem in their plants and found a good solution. We would like to know the capacity, placement, size and type fans for best results. We are also puzzled as to what air velocity constitutes a draft.*

Since we will change the cafeteria's location in a few years, we plan to spend but little money on this job.—RD



Run Duct Along Walls

RD CAN HAVE good ventilation by running a duct near ceiling along each outside wall, sketch, above right, and uniformly spacing louvered openings at close intervals along entire length of each duct. If windows interfere, run duct along kitchen wall. Size of louvered openings should keep entering-air velocity to about 400 fpm.

Taper ducts between fan and far end; keep velocities to 2500 fpm or less. Inlets may be in side or bottom of duct.

Ducts may be painted or galvanized sheet metal, transite flexboard or plywood; first or second is preferred. Fans may be at one or both ends of each duct, either multivane or non-overload type, discharging vertically. If fans discharge horizontally, wind blowing into discharge opening may reduce capacity.

Ventilation rate of one air change per min gives results. Standard data

When you buy a SUPERIOR Steam Generator

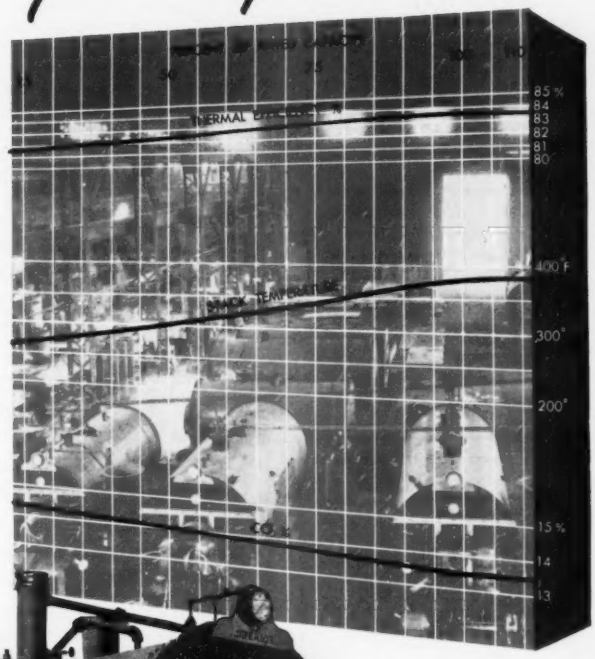
You Buy Results!

Superior Steam Generators are better designed, better made . . . results prove it.

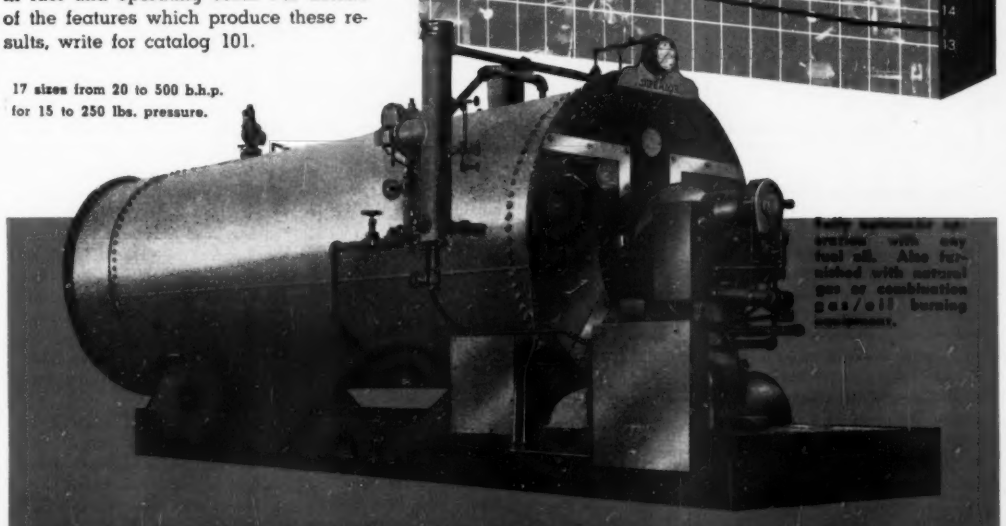
The accompanying graph tabulates the actual data recorded during recent tests performed on a Superior Steam Generator which has been in operation a full year. Professors Jackson and Holme of Lehigh University made the tests and recorded the data from instruments supplied by their university.

Note the high efficiencies developed over a firing range which varies from 25% to 110% of rated capacity . . . and these tabulations take *everything* into account . . . even the small water content of the steam was deducted from the thermal efficiency.

These high efficiencies spell savings in fuel and operating costs. For details of the features which produce these results, write for catalog 101.



17 sizes from 20 to 500 b.h.p. for 15 to 250 lbs. pressure.



Superior Combustion Industries, inc.

Factory Emmaus, Pa.

Executive Offices Times Building, Times Square New York 18 N. Y.

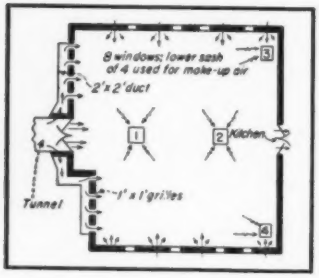
indicate restaurant air changes at rate of one change in 2 to 12 min.

This calculation shows how to handle problem: Room volume is 35,757 cu ft, and at 75 lb per 1000 cu ft = 2682 lb. Then, 2682x.24 = 645 Btu, heat content of one air change per deg F. Average sensible heat given off per person is 300 Btu per hr, or 5 Btu per min.

Heat from occupants per min is 225 × 5 = 1125 Btu. This gives 1125 ÷ 645 = 1.75-F rise with one air change per min. Temperature rise is inversely proportional to number of air changes.

Above assumes normal summer temperatures. If inlet air is cooler, volume must be reduced. Other factors are heat given off by food, moisture from food and persons, heat from coffee urns, steam tables, etc. All these increase heat load to remove. So it pays to provide plenty of capacity with means to adjust to weather and internal conditions.

IRA A BUTCHER *Piney River, Va.*



Two Methods Outlined

WITHOUT all information necessary, I recommend supply and removal of about 7000 cfm of air, changing it completely about every five minutes. Applying ASHVE recommendations here, location of exhaust intakes is not too critical, nor is an elaborate system needed.

A desirable exhaust arrangement consists of a metal penthouse with a motor-driven belt-connected propeller fan, having automatic back-draft louver shutter and hinged rainproof cover. When installing the system, do not discharge against prevailing wind.

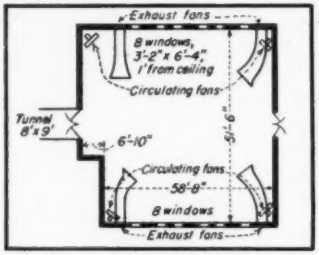
RD has a choice of two practical methods for his job:

1. Install 10 throw-away type filters, 16x25x2 in.—one in lower sash of 8 windows and one in each lower panel of tunnel doors. These 10 openings will be the source of makeup air. Install 2 ceiling grilles (1 and 2 in above sketch) and overhead exhaust fans, each capable of moving about 3000 to 4000 cfm.

2. Supply all makeup air through tunnel. Install 2 ducts, 2x2 ft, with filters from tunnel along outside dining-room wall. In addition, place filters in lower panel of each door. Then install ceiling grilles (3 and 4 in same sketch) with overhead exhaust fans, as in method 1.

Our plant cafeteria, where we also have three 40-min lunch periods, has a problem similar to *RD's*. We use unconditioned outside air entirely and find it satisfactory.

WM B PRIDE *Seattle, Wash.*



Circulation and Exhaust Fans Are Best Choice

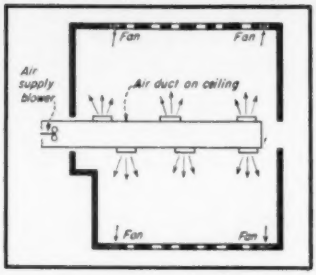
MINIMUM FRESH AIR for proper ventilation is 10 cfm per person. This means 2250 cfm for 225 people. Heat gain of 225 people is about 78,750 Btu per hr, not including heat from infiltration, lights and moisture present.

To take care of sensible heat from people only, assuming basement air is 75 F, would require removal of 78,750 Btu on a 10-deg buildup. Hence *RD* needs to pull 6500 cfm.

Drawing 6500 cfm of air from basement will result in its air gradually reaching temperature of the outside air. Remember that velocity of air through doorway will be 200 fpm, which is quite a draft. Also, the vacuum created will cause infiltration in dining room since air will be pulled through every crack and crevice in windows.

The best way for *RD* to handle the job is to use circulating fans in conjunction with exhaust fans. Place four exhaust fans with duct work as in above sketch. These should be slow-speed fans with a capacity of 500 cfm. Then put a 600- to 1000-cfm slow-speed circulator in each corner. Screen all windows and keep them open. Put awnings outside.

GEORGE GRIFFEL *New York, N. Y.*



Blower in Tunnel Duct

RD SHOULD INSTALL a duct as in above sketch. Blower in duct should supply about 10% less air than will be exhausted from the four window fans; infiltration makes up difference. Place openings in duct for even distribution throughout room.

It is good practice to furnish from 15 to 20 cfm of air per person in room. Make certain that pressure inside dining room is higher than in kitchen; otherwise, when doors open, the exhaust system in kitchen will be unbalanced.

Velocities up to 40 fpm will not cause serious drafts for this type installation.

F D RAPHAELIAN *Ridgefield Park, N. J.*

Four 20-In. Fans OK

RD NEEDS a total fan capacity of about 5000 cfm, or four fans each rated 1250 cfm. This capacity is based on standard ventilating practices for cafeterias. It is assumed half the people are smoking at some time during their 40-min. lunch period. Sun load for one side of building and heat load for one lunch period were assumed to be present for 2 hr.

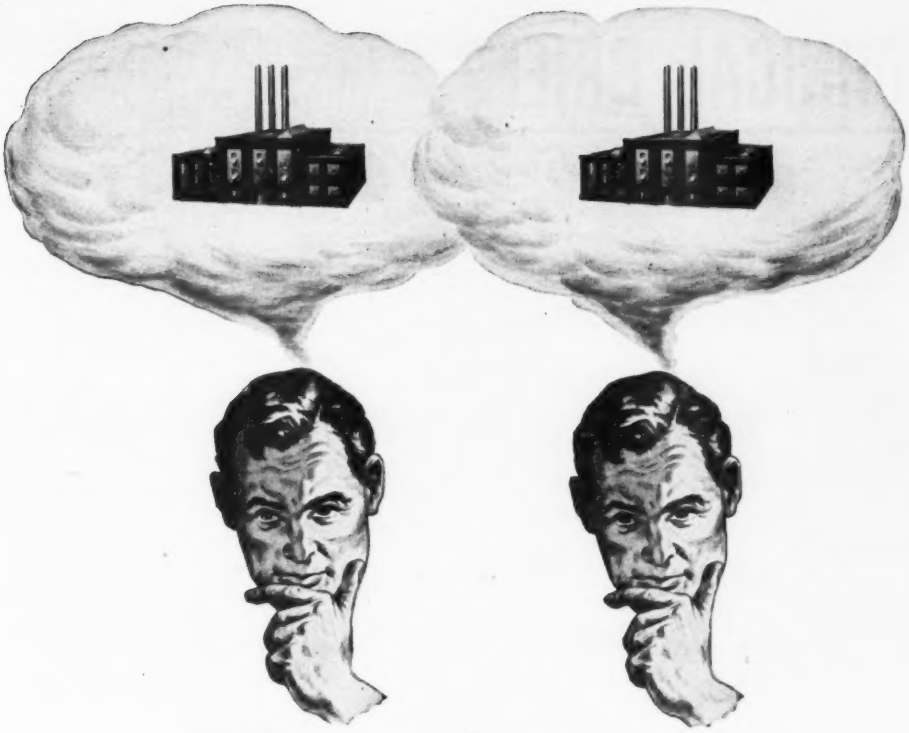
Recommended capacity (5000 cfm) will provide approximately 8½ air changes per hour. Good practice calls for 6 to 10 air changes per hour for cafeteria ventilation. If placed as shown on *RD's* sketch, fans will provide even distribution of air.

Propeller fans are well adapted for this type of ventilating service. Although *RD* wants to keep costs down, the noiseless propeller fan, which has a slightly higher cost than the standard model, would be best. Four 20-in.-dia propeller fans will be satisfactory.

To prevent drafts, air velocity, measured 36 in. above floor, should not exceed 50 fpm. *RD's* tunnel will be drafty but since installation is only temporary, prevention is not warranted.

TYLER G HICKS *New York, N. Y.*

(*Continued on page* 152)



Think Twice...

...before you select *any* water conditioning service.

In the selection of the water conditioning service *best* suited for *your* boiler plant, it will pay you to consider carefully these three vital factors for successful, economical boiler plant operation:

- A service based on a sound engineering background
- A service with a proved record
- A service backed by ample engineering facilities

Trouble-free operation is a result of scientific control.

W. H. & L. D. BETZ is an organization of engineers and chemists specializing in the solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical.

Our nationwide staff of engineers will welcome the opportunity of discussing with you this important subject of water conditioning . . . W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

TECHNICAL BRIEFS

ENGINEERING DEVELOPMENTS HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

REVIEWED IN THIS ISSUE

SYNTHETIC FUEL
Coal for Synthetic Fuels

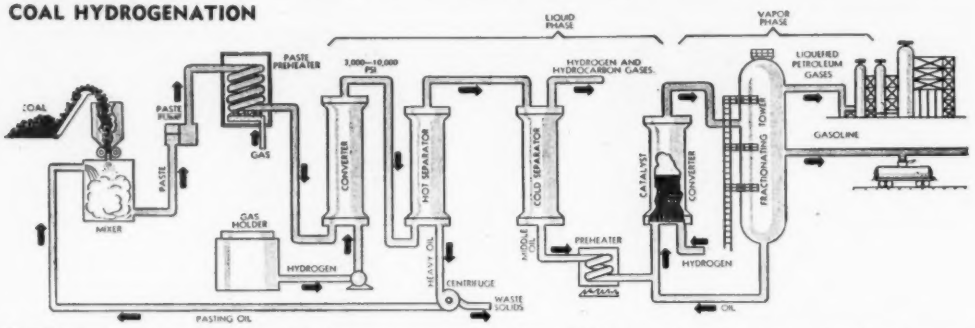
WELDING
Paper-Mill Maintenance
Effect of Fabrication

WATER TREATMENT
Some Trends in Conditioning Equipment
Sludge-Blanket Softeners
Precise Water Control

STEAM TURBINES
Speed-Governor Design

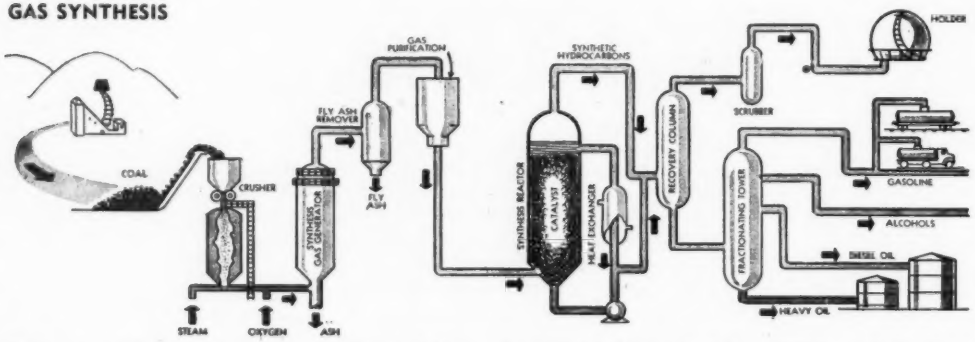
Directions for ordering papers are given on page 120

COAL HYDROGENATION



1 Producing liquid fuel by the coal hydrogenation process involves at the present stage of development an investment of about $9000 a daily barrel to produce equal parts of gasoline and distillate fuel, according to latest data available

GAS SYNTHESIS



2 The gas-synthesis process, according to Bureau of Mines estimates, can produce liquid fuels, about 90% gasoline, for a capital investment of about $8500 a daily barrel. A synthetic fuel-oil program from coal now seems promising

SYNTHETIC FUEL

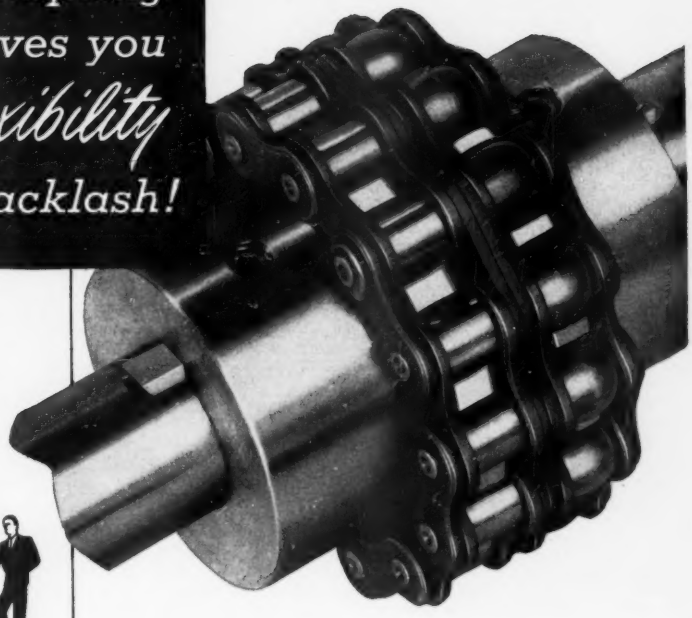
COAL FOR SYNTHETIC FUELS, *by J D Doherty, Bureau of Mines, U. S. Dept of the Interior.* Three principal sources of synthetic oil are (1) natural gas (2) oil shale (3) coal. A commercial plant using natural gas is under construction. But since the number of Btu's in fuel of high heat value delivered through gas lines runs about twice the amount that can be delivered in liquid fuel made from gas, present indications point to only a small percent of our gasoline from this source.

U. S. oil shale reserves contain recoverable oil equivalent to at least 125 times our present annual consumption. Partly because of low mining costs being demonstrated by the Bureau of Mines at Rifle, Colo., this alternate source appears most promising economically for large-scale production. But several factors reduce this promise.

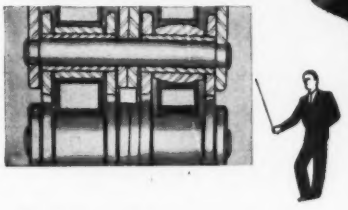
Chief among them are: (1) distance of the more economical shales from the market area (2) the fact that these shales yield heavy fuel oils, require hydrogenation or special refining for large yields of motor fuel. Because of this the production of diesel oil and gasoline from coal is likely to be developed simultaneously with shale oil.

To meet anticipated increases in domestic consumption of liquid fuel a suggestion has been made to produce 2 million barrels of synthetic oils per day from coal, oil shale and natural gas.

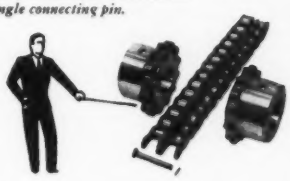
this Coupling gives you *True flexibility* without backlash!



1. *True flexibility...maximum shock-absorbing ability because pins bend.*



2. *Easily installed or disconnected with single connecting pin.*



3. *All-steel. No short-lived material.*

● Baldwin-Rex Tru-Flex Couplings give you true flexibility without destructive backlash. These efficient chain couplings with their exclusive convex rollers on one chain strand give you better all-round performance . . . more protection for your machines . . . longer service. Here's why:

The convex rollers maintain only line contact with sprocket teeth and because of this contact, pins are designed to flex or bend. The flexing of the pin, plus the inherent flexibility of roller chains, accommodates misalignment, allows end play, and absorbs greater torsional shock loads. Too, this design permits the chain to be fitted snugly around the sprockets as contrasted to the "sloppy fits" of ordinary chain couplings. This, plus the fact that no short-lived materials are needed to give flexibility, makes it easy to see why Tru-Flex Couplings will give you longer, more efficient service.

For all the facts on Tru-Flex Couplings . . . how their single pin construction makes installation and disconnecting easy without an axial shift of either shaft . . . how they dampen pulsating loads . . . and their many other features, send for your copy of Bulletin No. 48-6. Address Baldwin-Duckworth Division of Chain Belt Company, 387 Plainfield Street, Springfield 2, Mass.

BALDWIN·REX

ROLLER CHAIN COUPLINGS

The author assumes that half this output will come from coal. And he further assumes half the oil from coal will come from the Fischer-Tropsch process, Fig. 2, and half from coal hydrogenation, Fig. 1.

Bureau of Mines estimates indicate 575,000 tons of coal and lignite per calendar day, or a daily output of 805,000 tons on a 5-day mine week. This amounts to 210 million tons per year, a 34% increase over 1947 production. Of this consumption, 213,000 tons per day would be bituminous coal mined east of the Mississippi, whereas 362,000 tons would be coal and lignite mined in the West.

For producing liquid fuels (90% gasoline) by the gas-synthesis process, a capital investment of $8500 per barrel would be required, according to estimates. For coal hydrogenation process an investment of about $9000 a barrel would produce equal parts of gasoline and distillate fuel. A plant to produce chiefly fuel oil (60% heavy) from oil shale can be erected for about $3000 per daily barrel. *AIME Paper.*

To Obtain Complete Text

Material in the briefs comes from one of these sources:

Joint Fuels Conference, Fuels Div, ASME, and Coal Div, AIME, White Sulphur Springs, W. Va., Nov. 2-3, 1948. Papers, identified by *AIME*, are available at AIME, 29 W 39 St, New York 18.

American Welding Society, 29th annual meeting, Philadelphia, Oct 25-29, 1948. Papers identified by *AWS*, available at AWS, 33 W 39 St, New York 18.

Ninth Annual Water Conference, Engineering Society of Western Pa., Pittsburgh, Oct 18-20, 1948. Papers, identified by *ESWP*, are available in proceedings, $7.50 through Engineers Society of Western Pa., Hotel Wm Penn, Pittsburgh.

American Institute of Electrical Engineers, Midwest general meeting, Milwaukee, Oct 18-22, 1948. Papers, identified by *AIEE* and paper No., available through AIEE, 29 W 39 St, New York 18.

WELDING

WHAT MAINTENANCE DEPARTMENT CAN DO WITH CUTTING AND WELDING IN A PAPER MILL, *by Jamison Moore, Union Bag & Paper Corp.* Increased and improved use of cutting and welding has contributed materially to lower maintenance costs and better quality production at this author's Savannah plant.

Standardized equipment and methods, plus a thorough investigation of new machines and processes, have extended the life of machine parts, overcome material shortages and reduced lost time. The author describes helpful cutting and welding procedures. *AWS Paper.*

THE EFFECT OF FABRICATION PROCESSES ON STEELS IN PRESSURE VESSELS, *by C J Osborn, A F Scotchbrook, R D Stout and B G Johnston, Lehigh University.* This is a report on an extensive investigation to compare various steels for their relative tendency toward brittle behavior at low temperature. Two steels, rimmed and aluminum killed, each in two thicknesses, 5/8 and 1 1/4 in., serve as samples. *AWS Paper.*

WATER TREATMENT

TRENDS IN MODERN BOILER FEEDWATER-CONDITIONING EQUIPMENT, *by S B Applebaum Liquid Conditioning Corp.* External system of feedwater conditioning comes in for close scrutiny. Twelve modern methods of so treating boiler water are compared for (1) degree of hardness removal (2) alkalinity reduction (3) total solids reduction (4) lowering of free CO_2 in the steam (5) reduction of silica in effluent (6) question of whether raw water must be preclarified (7) relative degree of skill required for operation.

Higher boiler pressures call for lower total solids, lower alkalinity and much lower silica. This set in motion a trend in favor of hydrogen zeolite to produce the low-solids and low-alkalinity waters coupled with a 2-stage hot-process softening system to accomplish a reduction in silica while softening the water.

Sodium zeolite plus acid still ranks as a strong contender where simplicity of operation is important, and where silica reduction is not indicated. If raw water is not clear and silica reduction seems important a combination of cold-process lime treatment followed up by sodium zeolite is well regarded. It proves particularly applicable where cooling-water makeup is drawn from the prelime treater, and boiler feed makeup from the sodium zeolite. *ESWP Paper.*

THE SLUDGE-BLANKET HOT-PROCESS SOFTENER, *by J D Yoder, Permutit Co.* Sludge-blanket hot-process softener differs from the conventional in that the sludge forms a suspended blanket through which treated water filters rather than settling out as a useless and inert mass. Using a sludge blanket this way gives softeners, ranging in size from 3600 to 70,000 gph, certain advantages: (1) better silica removal (2) more efficient use of magnesia (3) lessened chemical costs (4) lower turbidity in settling tank effluents (5) longer filter runs (6) greater adaptability to fluctuations in flow rates (7) easier operation. *ESWP Paper.*

PRECISE CONTROL OF BOILER-WATER CONDITIONS, *by Dr R E Hall, Hall Laboratories.* Many different forces have developed present-day water-conditioning procedure. Because these forces' pattern keeps changing, only boiler-water conditioning is discussed.

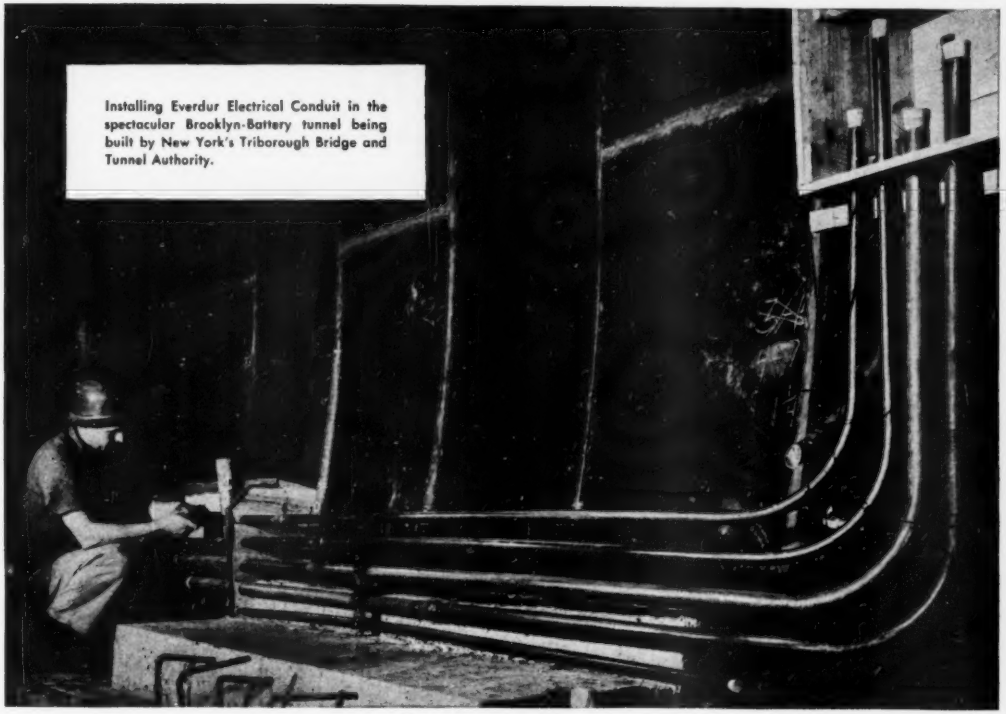
Pointing out briefly the many agencies and forces active in building up the technology of water-conditioning, he applies their accomplishment to the definition of precision control for the main operations in boiler-water conditioning. For instance, in testing for steam quality, the use of conductimetric methods in conjunction with degasifying equipment has supplemented for the most part the throttling calorimeter.

The author gives considerable attention to the phosphate control of boiler water as a means of limiting magnesium-phosphate formation and thereby fixing silica in nonvolatile combination. *ESWP Paper.*

STEAM TURBINES

SPEED GOVERNING DESIGN CONSIDERATIONS FOR MULTIVALVE CONDENSING STEAM TURBINE-GENERATORS, *by J W Barnett, General Electric Co.* In the governing system (for a condensing turbine) described in the paper the objective has been achieved of giving an almost straight-line plot of load versus servomotor stroke. The servomotor has a skirted piston to give smaller forces in the closing direction. Smaller forces are needed because of the aid given by the governor-valve springs and the unbalanced steam forces in closing the valves. The governor head positions a rotating pilot valve, which controls the admission and rejection of high-pressure oil to the servomotor piston through the relay system.

The starting handwheel controls the governor valves through the oil relay system and by proper positioning acts as a load limiting device without any auxiliary adjustments being necessary. Manual overspeeding can be done at will to test the overspeed governor. Special attention must be given the effect of entrained steam and flashing of steam in heaters fed from bleed points in design of the overspeed governor and check valving provided between turbine and heaters. *AIEE Paper No. 48-280.*



Installing Everdur Electrical Conduit in the spectacular Brooklyn-Battery tunnel being built by New York's Triborough Bridge and Tunnel Authority.

EVERDUR CONDUIT

protects wiring in nation's biggest under-water tunnel

IN NEW YORK'S new 77 million dollar Brooklyn-Battery vehicular tunnel, one and three-quarter miles of Everdur* Conduit will carry traffic light and control cables, telephone and other communication lines. Both RC and EMT are being used in sizes from ¾" to 4".

Control boxes will be located every 250 feet along this 9,117 foot four-lane sub-marine boulevard. These boxes are likewise being fabricated from Everdur Copper-Silicon Alloys.

No stranger to long-term service under extremely corrosive conditions, Everdur Conduit has performed impressively on the Delaware River Bridge since 1935, and in Pennsylvania Turnpike tunnels since 1940. Its long life in refineries, sewage plants and chemical works are good reasons for its use under New York Harbor.

Everdur Conduit possesses high strength, is non-magnetic, workable and weldable. It is available in two wall thicknesses: rigid conduit (RC) in nominal sizes from ¼" to 4" inclusive; and the thinner walled electrical metallic tubing (EMT) in nominal sizes ⅜" to 2" inclusive. Complete lines of fittings . . . connectors, couplings, outlet boxes, etc. . . . are available in Everdur Alloys from leading manufacturers.

*Reg. U. S. Pat. Off.

ANACONDA

Everdur

ELECTRICAL CONDUIT

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

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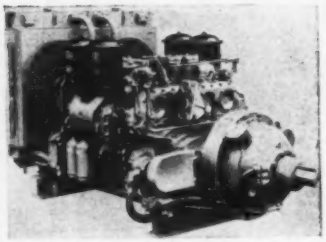
New Toronto, Ont.

NEW PLANT EQUIPMENT



Diesel Torque Converter E16

SPECIFICALLY ENGINEERED to General Motors Series 71 diesels, torque converter and fluid coupling unit consists of four major elements—pump, turbine, two stators—compactly designed to occupy no more space than conventional clutch and power takeoff. Employing the flywheel as a working part of the torque-converter assembly makes this compactness possible. Unit produces a torque multiplication of 4 to 1. It serves to pick up load with maximum lifting power and shifts automatically from torque converter to fluid coupling in higher speed range. This permits maintaining high efficiency through a wide speed range. Unit is available in the Single 3, 4 and 6 and Twin 4 and 6 (illustrated) Series 71 models having engine ratings from 75 to 300 hp. **Detroit Diesel Engine Div, General Motors Corp, 13400 West Outer Dr, Detroit 28, Mich.**

Demineralizer E30

HYDRION DEMINERALIZER produces mineral-free water by passing it through a column of ion-exchange resins. The water produced is equal in chemical purity to a highly controlled quality distilled water and is suitable for batteries.

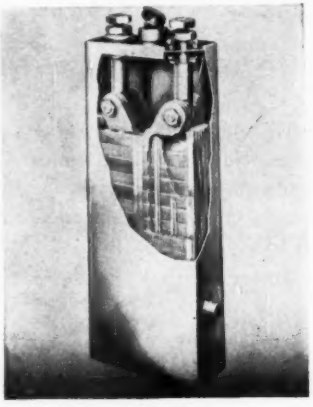
The unit consists of a replaceable cartridge, a wall cartridge holder, and an electronic indicator for quality of treated water. Cartridges are charged with two synthetic ion-exchange resins. A cation resin removes the metallic ions, such as calcium, magnesium, iron, sodium, and replaces them with hydrogen ions, converting the mineral salts into acids. The other resin, called the anion, removes acid. Each cartridge has a capacity of 1100 grains of hardness removal. The limit for good water is calibrated for an endpoint of an electrical resistance of 50,000 ohms per cc. This indicates a purity of about 10 ppm of dissolved minerals. **A E Tomkin & Co, P O Box 7311, Washington 4, D. C.**

Dial Thermometer E33

DIAL-TYPE indoor-outdoor thermometer has gold characters and dubonnet background on the dial. Upper scale reads from minus 30 to plus 110 F. The lower indoor scale reads from plus 50 to plus 90 F. Speedometer type pointers clearly indicate the temperatures. Dial is protected by a strong, curved, molded crystal that prevents reflection of light. Sensitive metal bulb is fastened outside the building on a bracket provided, and the armored capillary tubing is small enough to pass between window sash and casing. **Dept 123R, Jas P Marsh Corp, Skokie, Ill.**

Silver Alloy E22

HIGH SILVER ALLOY, developed to supplant silver brazing alloys, gives good color matching for stainless steel, says its maker. *Eutecrod* 1700 is recommended for making lap, square, butt and "T" joints and for sealing cracks and defects for stainless steel, copper, brass, bronze, tungsten carbide and steel. It binds at 1020-1250 F; has a tensile strength of 64,000-68,000 psi. It is available in $\frac{3}{32}$, $\frac{1}{16}$, $\frac{5}{64}$, $\frac{3}{32}$ and $\frac{5}{32}$ in. diameters. **Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N. Y.**

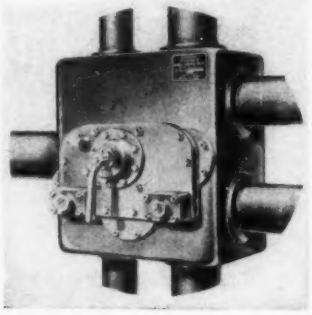


Nickel-Cadmium Battery E1

FEATURING LONG LIFE, high mechanical strength, low internal resistance, low rate of self discharge and low operating cost, the *Nicad* battery, in addition, is not subject to sulphation or other similar deterioration.

Active material in this cell is nickel hydroxide and treated graphite for the positive plate, while negative plate consists of a mixture of cadmium and iron oxides. Electrolyte is a solution of pure caustic potash in distilled water.

Nickel-cadmium cell is suitable for diesel-engine starting, auxiliary power systems, emergency lighting, switch closing and portable lamps and lanterns. **Nickel Cadmium Battery Corp, Easthampton, Mass.**



Control Valve E28

HYDROMATIC CONTROL VALVE simplifies operation of all types of zeolite softeners, ion-exchange systems and pressure filters, and minimizes the possibility of faulty operation through error in manipulation. Valve is a 6-position unit with four normal operating positions and two standby positions. In addition to integrating the functions normally performed by a valve nest, the hydromatic valve incorporates such features as built-in backwash and rinse rate controllers, which reduce space requirements.

For zeolite systems, the four operating positions provide separate control of backwash, regenerant feed, rinse and service, so separate flow rates may be assigned to each operation. Hydromatic valve is power actuated, power for operation of the valve members being provided by the raw water itself. This confines the force required for positioning—either manual or automatic—to a miniature disk-type pilot valve. **Cochrane Corp, 17th St & Allegheny Ave, Philadelphia 32, Pa.**

Gas Analyzer E29

ANALYZER WORKS on the standard principle of thermal-conductivity gas analysis, which measures the rate at which heat is conducted by the gas being sampled. Instrument, mounted in an explosionproof case, is unaffected by voltage variations, ambient temperature and variations in sample pressure. An all ac circuit is employed, permitting the use of a standard Bailey electronic recorder that does not require dry batteries or standard cell. It requires no

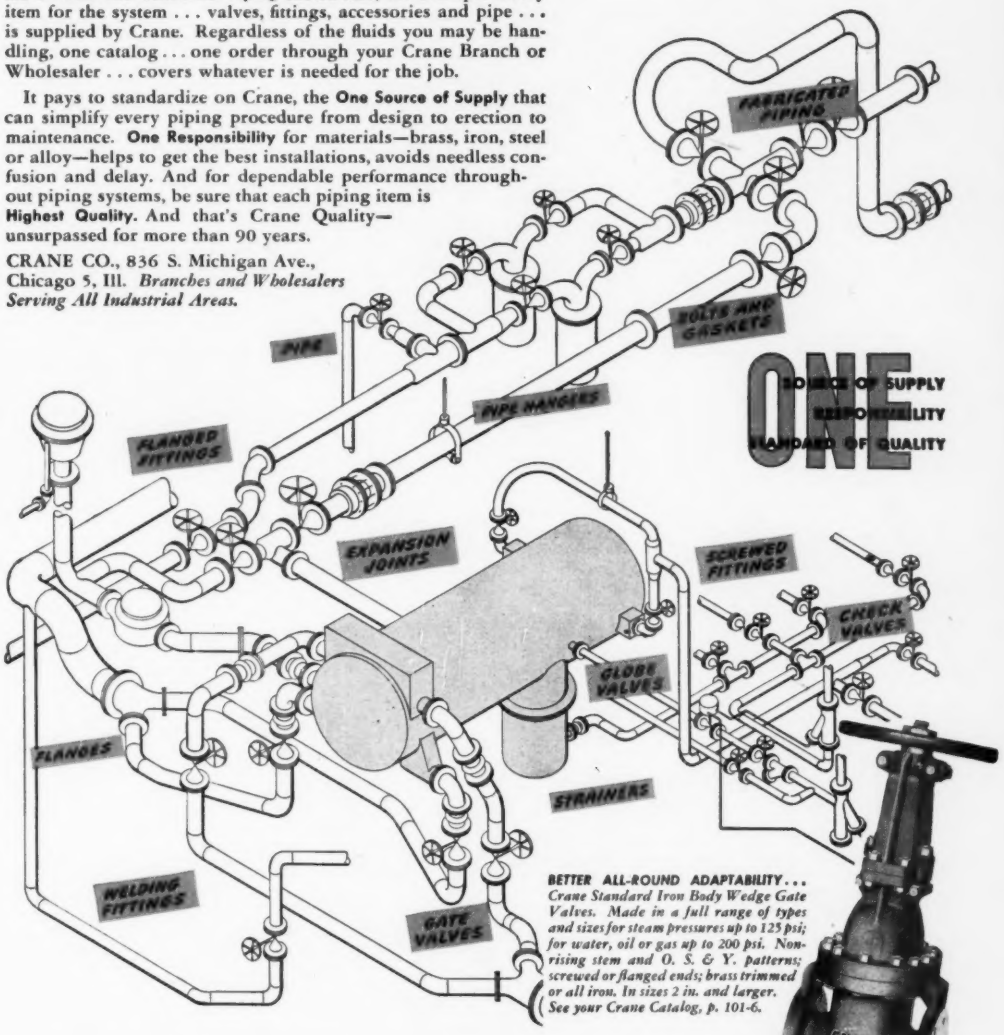
Use convenient reply cards on page 180a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

Complete Piping Materials Service
... from one complete line

That's the Crane line—the world's most complete source of piping equipment for power, process and general utility services. **Take the Exhaust and Condenser Piping shown here,** for example. Every item for the system . . . valves, fittings, accessories and pipe . . . is supplied by Crane. Regardless of the fluids you may be handling, one catalog . . . one order through your Crane Branch or Wholesaler . . . covers whatever is needed for the job.

It pays to standardize on Crane, the **One Source of Supply** that can simplify every piping procedure from design to erection to maintenance. **One Responsibility** for materials—brass, iron, steel or alloy—helps to get the best installations, avoids needless confusion and delay. And for dependable performance throughout piping systems, be sure that each piping item is **Highest Quality.** And that's Crane Quality—unsurpassed for more than 90 years.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill. *Branches and Wholesalers Serving All Industrial Areas.*



BETTER ALL-ROUND ADAPTABILITY . . . *Crane Standard Iron Body Wedge Gate Valves. Made in a full range of types and sizes for steam pressures up to 125 psi; for water, oil or gas up to 200 psi. Non-rising stem and O. S. & Y. patterns; screwed or flanged ends; brass trimmed or all iron. In sizes 2 in. and larger. See your Crane Catalog, p. 101-6.*

EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

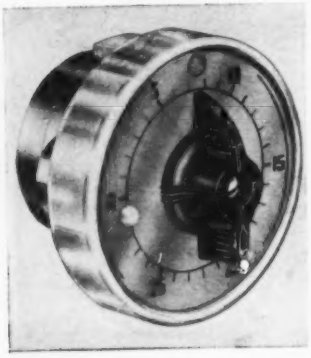
FOR EVERY PIPING SYSTEM

manual attention or adjustment, except for routine maintenance.

Bailey electronic recorder measuring circuit employs an ac potentiometer that operates on the null-balance principle. Voltage drop across sample cell of analyzer is automatically balanced against voltage drop across a motor-driven slide-wire unit in the recorder. Recording pen is connected to slide-wire unit and any unbalance repositions the pen to record in terms of the factor being measured. The recorder employs electron tubes instead of a galvanometer. **Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio.**

Condensate Return E19

COMPLETELY AUTOMATIC, packaged condensate return unit, Type *UA*, includes pump, motor, receiver tank, float switch, a strainer, pipe and base. The 20-gal unit returns condensate at high temperatures under the action of a turbine-pump equipped with bronze liners and impeller. **Roy E Roth Co, Rock Island, Ill.**



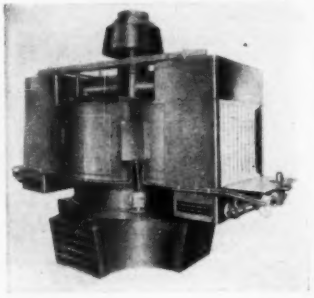
Electrical Timer E3

A COMPACT TIMER is designed for light duty and is suitable for time ranges up to four hours. Timer is operated through a synchronous motor; operating switch is rated 12 amp at 125 v, ac. Designated as *SK*1037, interval timer is available for both front and rear panel mounting. **Haydon Mfg Co, Torrington, Conn.**

Insulating Tape E4

WHEN APPLIED under normal wrapping tension, *Bi-Seal* electrical insulating tape coheres to itself and other insulation, producing a permanent insulating jacket. This tape is a blend of synthetic polymers and resins and is compatible with butyl rubber, polyethylene, and vinyl resins.

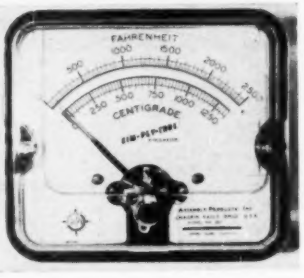
Having a dielectric strength of over 1000-v per mill thickness in addition to good aging characteristics, *Bi-Seal* is resistant to ozone, moisture, acids and alkalies. Tape is available in 1-lb rolls of any desired width, at a standard thickness of 0.020-in. **Bishop Gutta Percha Co, 420 E 25th St, New York, N. Y.**



Unit Heater E18

SELF-CONTAINED, gas-fired revolving unit heater uses either natural or manufactured gas. The heater combines gas burners, heat exchanger and combustion chamber with a motor-driven fan and revolving discharge outlets.

Designed for overhead location, heater projects air to working level. Revolving outlets circulate the warm air in all directions. During the summer merely turning off the gas and leaving the fans on gives good air circulation. **L J Wing Mfg Co, New York, N. Y.**

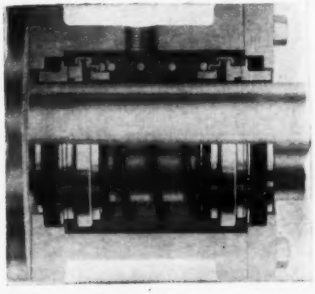


Pyrometer E37

SIMPLYTROL INDICATING PYROMETER has a dial calibrated in both Fahrenheit and Centigrade with a clear plastic front. Instrument is available in several ranges up to 2500 F and 1370 C, making it suitable for furnaces, kilns, ovens and various baths.

Four ohms per millivolt gives a resistance of 212 ohms for 2500 F. Thermocouple does not need calibrated leads. Meter is calibrated for 10 ohms external resistance (8 ohms for 500-F range). A suitable resistance spool, connected in thermocouple circuit, is brought out to an extra terminal on back of the meter. With this in the circuit, thermocouples with uncalibrated leads up to 15 ft are used. When longer leads are required, this resistance is left out of the circuit, and will accommodate leads up to 100 ft long. Instrument is fully compensated for ambient temperature.

Simplytrol pyrometer element, fitted with platinum contacts, is also available for temperature control. Positive action is assured by the *Micro-Contact*, which operates at the instant of initial contact. An auxiliary circuit locks the contacts together with sufficient pressure to prevent chattering or floating. **Assembly Products, Inc, Main and Bell St, Chagrin Falls, Ohio.**



Rotating-Shaft Seal E25

SIMPLE ROTATING-SHAFT SEAL has only three components, a rotating member held by a compression spring against a fixed surface or stationary seal. It prevents leakage of liquid or gas along a rotating shaft of water or oil pumps, refrigeration compressors, speed reducers and similar equipment. Double seals are also available. They have two rotating seals mounted on opposite ends of a compression spring. These are applicable where the liquid pumped cannot act as a lubricant or coolant. For these applications a separate liquid supply is used in the seal chamber. **Gits Bros Mfg Co, 1846 Kilbourn Ave, Chicago 23, Ill.**

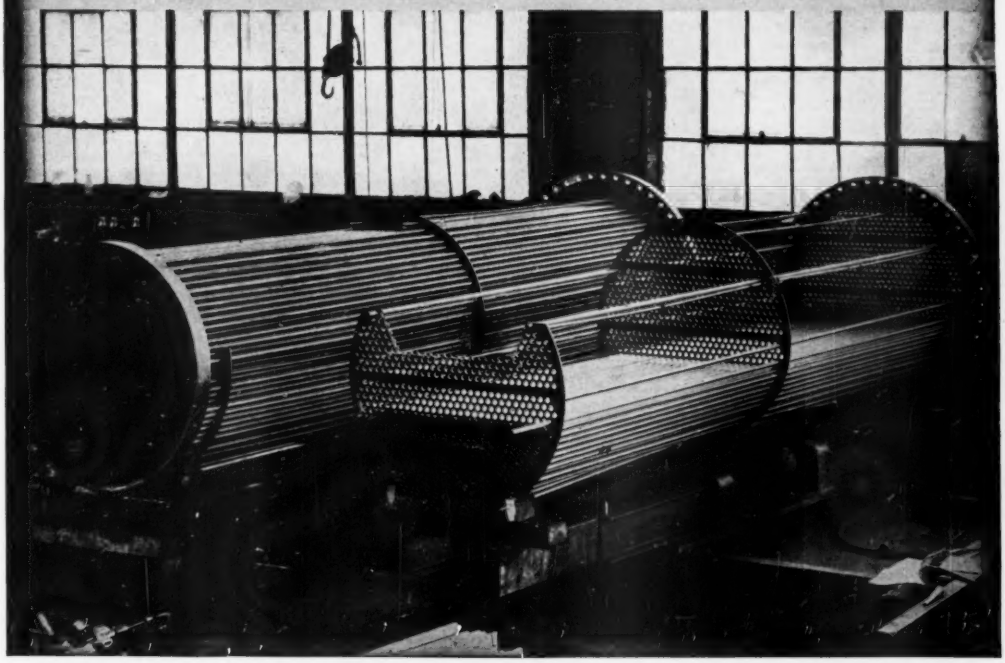
Temperature Recorder E31

SPEEDOMAX INSTRUMENT automatically logs as many as 160 separate thermocouple temperatures in succession at a rate of four seconds per point. Because each point is checked at such frequent intervals, high or low temperatures that may develop can be spotted readily before serious trouble results. In case of trouble, the operator can cut thermocouples out of the measuring sequence in banks of 20 at a time, until the instrument is concentrated on a particular group of temperatures in which he is interested at the moment.

He can also set the instrument to record

Use convenient reply cards on page 180a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

IT'S IMPORTANT TO KNOW ALL THE FACTORS AFFECTING CONDENSER TUBES



In selecting condenser tubes it is often the case that such conditions as temperatures, pressures, and compositions of the gases and fluids will be taken into account fully, only to have the tubes thus chosen give short service. In such cases, it is wise to call in Revere and ask for a thorough check of the situation before assuming that the wrong alloy was specified.

Here is a case in point. Admiralty tubes in a high stage condenser in a refinery were lasting only three or four months. In the effort to increase life, the sour gas had been treated, but as no improvement was experienced, the treatment was discontinued. The Revere Research report, made after laboratory investigation, stated that Admiralty metal was the correct alloy and its use should be continued, but that microscopic study of a failed tube showed definite and conclusive evidence of fatigue corrosion, probably due to vibration. A conference with the people at the plant revealed that the condenser vibrated considerably. Hence the obvious recommendations: cut down the vibration by better bracing, resume treatment of the gas, and continue to use Admiralty tubes. These recommendations were followed, and when last checked the new Admiralty tubes had been serving for eight months and were still going.

The Revere Technical Advisory Service is eager to serve all users of condenser tubes and plates through close collaboration in the study of difficult problems.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

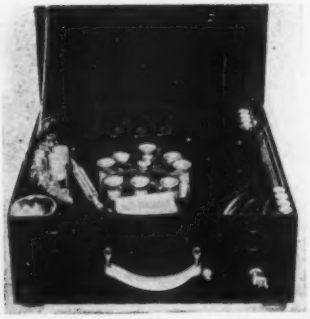
Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

NEW EQUIPMENT CONTINUED

any single thermocouple, or to record all points continuously. In usual operation, the instrument simply indicates, while numbered lights identify each couple. Should any temperature reach a preset limit, *Speedomax* automatically starts its recording chart drive, begins to record all points as a series of numbered dots, and operates an alarm. **Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.**

Floor Patch E24

HIGH-SPEED CONCRETE FLOOR repairs can be made with *Tampatch*. Material comes ready-mixed and is applied directly to concrete surface needing repair. If applied to floors, the surface can be placed in service shortly after repairs without any lengthy drying-out period. **United Laboratories, Inc, 16801 Euclid Ave, Cleveland 12, Ohio.**



Oil Test Kit E7

PORTABLE TEST KIT measures following four classes of contaminants: (1) change in viscosity because of fuel dilution or other causes; (2) amount of asphaltic and other oil breakdown substances considered responsible for deposits; (3) amount of dirt, metal particles, other solids and water; (4) acidity, showing whether corrosion is possible.

Accuracy may be obtained even when used by relatively unskilled employes. Oil for four engines may be analyzed in 20-25 min. **Gerin Corp, Red Bank, N. J.**

Copper Tungsten Contacts E8

GIBSILOY UW6 electrical contacts interrupt high current with a minimum erosion. They are suitable for service as air circuit breaker arcing tip and intermediate contacts, oil circuit breaker arcing tips and current-carrying contacts, oil-immersed contactor contacts, and oil-immersed transformer tap changer contacts. Contacts are molded to shape and one surface is coated with silver solder to facilitate brazing. **Gibson Electric Co, 8362 Frankstown Ave, Pittsburgh 21, Pa.**

Control Center E5

DUST-TIGHT control-center design permits use of standard motor-control units, such as those used for general-purpose application, in areas where excessive dust is present. Unit features flexibility in meeting future changes in motor-control requirements, safe dead-front operation, simple maintenance and neat appearance.

Units are available with circuit breakers rated through 600 amp, starters up to NEMA Size 5, lighting transformers, panelboards and other miscellaneous devices. **Square D Co, 4041 N Richards St, Milwaukee 12, Wis.**

Chipping Hammer E34

SMALL GENERAL-PURPOSE air chipping hammer incorporates a positive air jet that cleans off work surface. In addition to the usual chipping of rust, scale, weld flux, soot, paint and dirt, the tool is specifically recommended for cutting old windings in electrical motor-repair shops, chiseling wood in pattern shops, and cutting oil grooves in large bearings. Tool weighs slightly over 4 lb and is just over 10 in. long. Either a lever or push throttle is available. **Chicago Pneumatic Tool Co, 6 E 44th St, New York 17, N. Y.**

Stainless-Steel Electrode E21

ALL-POSITION WELDING with either ac or dc of stainless steel Types 301, 302, 304 and 308 is made possible with All-State No. 18/8 ac or dc stainless-steel electrode. It is available in $\frac{3}{64}$, $\frac{1}{16}$, $\frac{5}{64}$, $\frac{1}{8}$, $\frac{5}{32}$ and $\frac{1}{16}$ in. sizes. Weld metal deposits in a smooth, flat bead, according to the manufacturers, and with proper application gives welds of 80,000 to 95,000 psi tensile strength and 35 to 50% elongation in 2 in. **All-State Welding Alloys, Inc, White Plains, N. Y.**

Fire Extinguisher E36

DRY-CHEMICAL-POWDER EXTINGUISHER is designed for use against Class B and C flammable liquid and electrical fire. Unit is made in 20- and 30-lb capacities. When operating trigger is pulled, the powder chamber is immediately pressurized by carbon dioxide released from the small cylinder mounted on the side. Simultaneously, the powder relief valve in the top of the main body chamber opens, discharging fine powder through the hose and nozzle in a stream that carries 20 ft or more. Gravity and force of the chemical powder stream carry the powder down to the seat of intense fires. **Walter Kidde & Co, 40 E 34th St, New York 16, N. Y.**

Microfilm Camera E17

FLOFILM 42-IN. CAMERA can handle original copy up to 42 in. wide and in any length, making it particularly suitable for microfilming engineering drawings, blueprints,

(*Continued on page* 132)

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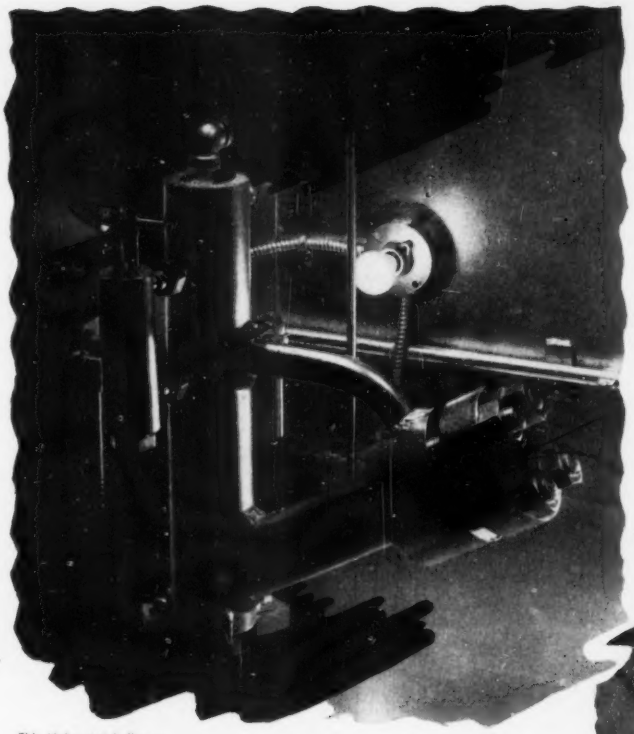

This Nalco test boiler, a 3,000 p.s.i. unit, is only 36 inches high! (Photo in Nalco Laboratories, before completion of insulation.)

3000 p.s.i.

is closer than you think!

...AND *Nalco* IS READY FOR IT!

Steel test tubes, taken from Nalco test boilers, accurately show scaling and corrosion effects of various water samples. From such tests, data leading toward new and better water treatment methods are obtained.

Steam generators operating at pressures up to 3,000 p.s.i. may be years away in practical use—but, test boilers in the Nalco Laboratories are operating at 3,000 p.s.i. *now*...helping to open the way to water treatment in the super-high-pressure range which will be as successful as the present Nalco System in thousands of plants having pressures from 0 to 2,500 p.s.i.

Whatever your boiler and plant operating conditions, the Nalco policy of keeping ahead in *successful* water treatment assures you of permanent results when the Nalco System goes to work for you.

This is Nalco, a 32-page, full-color bulletin describing the Nalco facilities available to you, is yours for the asking—call your Nalco Representative, or write direct.

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem, Limited Burlington, Ontario, Canada

THE *Nalco* SYSTEM • Serving Industry through Practical Applied Science

How to plan

OIL BURNER PIPING FOR LIGHT OILS

Another in the series of basic piping layouts prepared by Jenkins Bros.

Light and medium fuel oils, numbers 1, 2, 3 and 5 (cold), which do not require preheating can be handled in a layout such as shown here. Since the expense of a preheater installation can be eliminated, this relatively simple system is economical and easy to operate. Similar systems are often installed in hotels, apartment houses, taxpayers' office buildings, large residences, and small industrial plants.

Fuel oil, stored in an unheated tank, flows through a large mesh, twin-type strainer to a motor driven pump which provides the necessary oil pressure for satisfactory operation. The oil then passes through another fine mesh strainer, which removes any small particles that might clog the burner. Oil flow to the burner is controlled by a burner control valve which OPENS or SHUTS according to the boiler pressure.

Although one fuel oil pump can adequately handle the maximum boiler demands, two are recommended to provide a second pump for standby service in case of breakdown. Each pump is provided with a pressure relief valve as a protection against excessive oil pressure, which might become high enough to cause leaks in the oil piping. Check valves in the relief lines prevent relieved oil from entering the idle standby pump.

Bronze Valves are recommended throughout and must be of the appropriate pressure rating, usually

Jenkins PRACTICAL PIPING LAYOUTS

Illustrating the proved 3-point formula for trouble-free, time-defying hookups

A **Use the right type valve for the service.**
B **Place valves correctly in the line.**
C **Choose Jenkins Valves for lifetime economy.**

42

Fig. 962
Regrinding
BRONZE SWING CHECK VALVE
300 lbs. Steam 600 lbs. O.W.G.

300 lbs. Jenkins Fig. 976-A, the plug type globe valve recommended for the important individual burner shut-off, assures positive tightness when closed and extremely close regulation of oil flow, both essential to good oil burner operation.

Consultation with accredited piping engineers and contractors is recommended when adapting these suggestions to your own requirements, or when planning any major piping installations.

Copies of Layout No. 42 will be furnished on request. Just fill out and mail the coupon.

Fig. 962, the Jenkins Bronze Swing Check Valve indicated in this layout, is exceptionally serviceable for the non-return control of steam, oil, water and gas. It is generally used in connection with a gate valve, offering comparable full, free flow. It is particularly suitable for condensate and return lines as well as for feed and oil line service. The high tensile bronze disc can be reground easily without taking valve from the line.

A CHOICE OF OVER 500 VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run.*

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco.
Jenkins Bros., Ltd., Montreal.

JENKINS BROS., 80 White St., New York 13, N. Y.

Please send me a reprint of Piping Layout No. 42.

Name _____

Company _____

Address _____

JENKINS

LOOK FOR THE DIAMOND MARK
SINCE 1864

TRADE JENKINS MARK

Jenkins Bros

OIL BURNER PIPING FOR LIGHT OILS
BOILER #1
BOILER #2
BURNER CONTROL VALVE CONTROLLED BY BOILER PRESSURE
MANUAL CONTROL PLUG VALVE K
MANUAL CONTROL PLUG VALVE K
ROTARY FUEL OIL BURNER
ROTARY FUEL OIL BURNER
HIGH PRESSURE TWIN OIL STRAINER
BYPASS
HIGH PRESSURE OIL PUMP DISCHARGE LINES
BYPASS
PRESSURE RELIEF VALVE
AUXILIARY STANDBY FUEL OIL PUMP
OIL TO FUEL OIL PUMPS
SUCTION TWIN OIL STRAINER
OIL TANK VENT
FUEL OIL TANK
PRESSURE RELIEF RETURN TO OIL TANK
OIL TANK FILL LINE
PRESSURE RELIEF VALVE
MOTOR DRIVEN FUEL OIL PUMP
Diagram by Healey Maddaloin Consulting Engineer
VALVE RECOMMENDATIONS
For details and valves to suit varying conditions see Jenkins Catalog

Code	Quan.	Jenkins Valve	Type	Service
A	2	Fig. 47	Gate	Suction Strainer Shut Off
B	1	Fig. 950	Globe	Suction Strainer By-Pass
C	2	Fig. 47	Gate	Pump Suction Shut Off
D	2	Fig. 962	Swing Check	Pump Discharge Prevent Back flow
E	2	Fig. 970	Globe	Pump Discharge Shutoff
F	2	Fig. 962	Swing Check	Prevent Backflow in Pressure Relief Lines
G	2	Fig. 280	Gate	Discharge Strainer Shut Off
H	1	Fig. 970	Globe	Discharge Strainer Shut Off
J	2	Fig. 970	Globe	Oil Burner Shut Off
K	2	Fig. 976-A	Globe	Oil Burner Control
L	4	Fig. 703	Needle	Pressure Gage Control

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VALVES

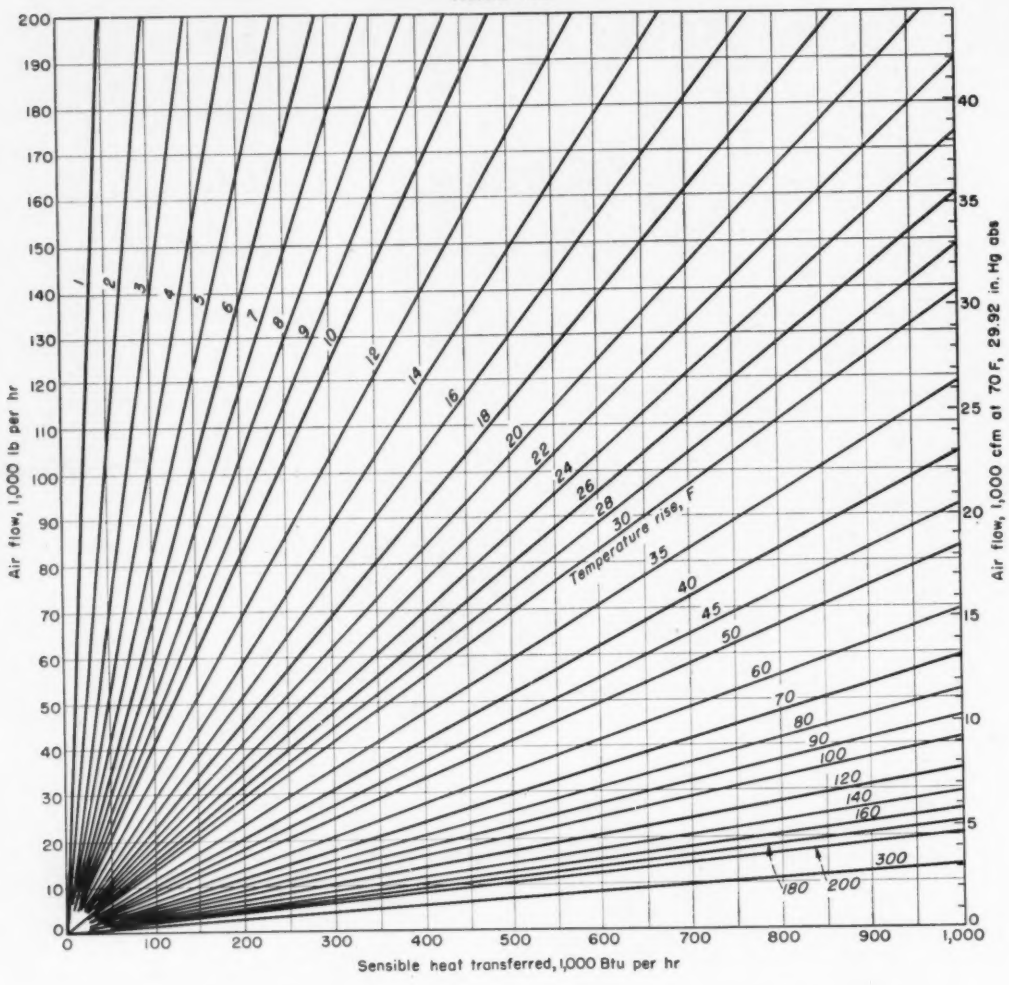
125 TO 600 LBS. STEAM PRESSURE

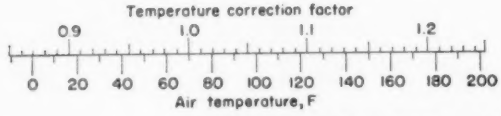
BRONZE · IRON · STEEL

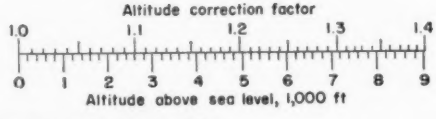
FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

Number 198







Sensible-Heat Transfer Chart for Air

▶ IN DESIGNING POWER PLANTS, manufacturing processes, ventilating and air-conditioning layouts, many repetitive calculations must be made in which these charts aid considerably. Main chart correlates air flow in cfm and lb per hr, temperature rise, and heat transferred in Btu per hr. It is based on air conditions of 70 F, 29.92 in. Hg abs, 0.075 lb per cu ft density, specific heat of 0.241 Btu per F per lb at constant pressure. Auxiliary scales give correction factors to compute cfm when air pressure and temperature depart from those on which chart is based. *Example:* What air flow must a fan handle that takes air from atmosphere at 110 F and 4000-ft altitude, forces it through a heater where it picks up 602,500 Btu per hr with 50-F rise?

Find 602,500 Btu per hr on horizontal ordinate, follow vertically to intersect 50-F rise curve. From here, read to left an airflow of 50,000 lb per hr. This corresponds to a hair more than 11,000-cfm air at 70 F and sea level, on right scale. To correct to given air conditions, on auxiliary scale below, find correction factor for 110 F of 1.075 and for 4000-ft altitude, 1.155. Then air flow = 11,000 × 1.075 × 1.155 = 13,650 cfm.

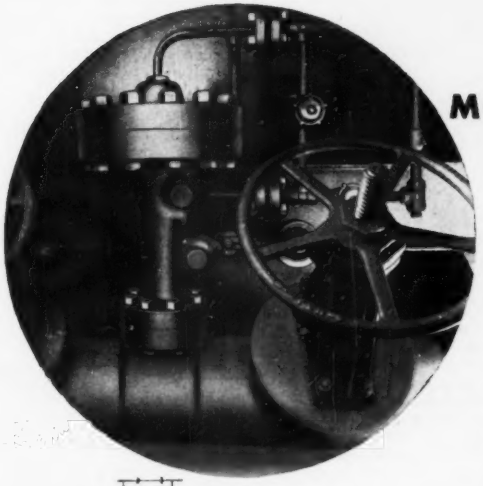
—BY TYLER G HICKS, *New York, N. Y.*

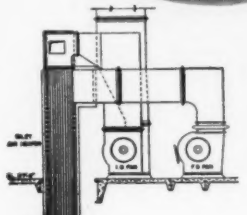
WATER GAS PLANT INSTALLS

28th COPES FEED WATER REGULATOR

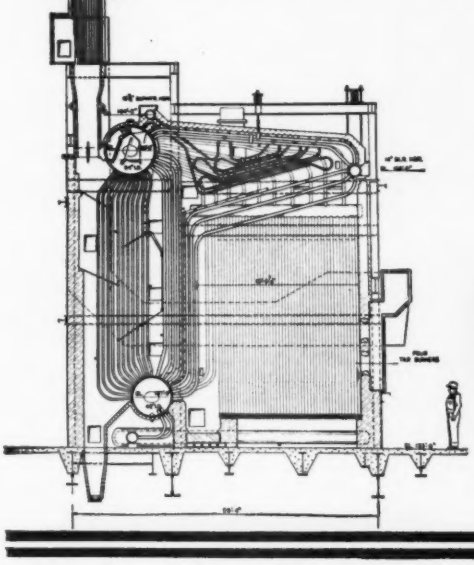
for

MOST UNUSUAL SERVICE





BULLETIN 483 tells the story of this Flowmatic on the Riley unit shown below, and gives the history of COPES in this important gas works. Write for it.



The twenty-eighth COPES Feed Water Regulator installed by a well-known gas company was for one of the first water-gas plant boilers ever to operate at 625-psi and 700-F. A two-element Flowmatic Type D-O, it gave excellent control of both feed flow and water level for the tar-fired Riley Type RP Steam Generator. Another Flowmatic has since been installed on a second 625-psi boiler.

This company had installed its first COPES in 1927 on a 175-psi, 500-F direct-fired boiler. Now five such boilers are equipped. In addition, every waste-heat boiler—on water-gas sets and on gas producers—is COPES-protected. Thirty-five COPES Regulators are in service.

NORTHERN EQUIPMENT COMPANY

191 GROVE DRIVE, ERIE, PENNSYLVANIA

BRANCH PLANTS in Canada, England, France, Austria, Italy. ***Representatives Everywhere***

COPES

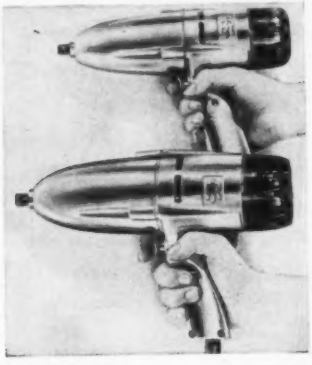
COPES

Headquarters for . . .

Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms.

maps, etc. Inverting the camera so copy passes over the lens makes possible the large reduction ratio necessary for handling wide copy. A 100-ft roll of film can take a copy up to ¾ mile long. Copy can be moved through camera at either 30 or 60 fpm; at the 60-ft speed a drawing 10 ft long can be microfilmed in 10 seconds.

The camera has an enlarging feature that permits "blowing back" images at reduced size, original size, or larger on a single sheet or roll of paper, in one operation. Any desired number of contact prints can be made from original roll of negative film. When converted to a flow enlarger the camera will print blow-ups of any desired image on photosensitive paper or cloth from the roll of negative film. A series of five buttons on the control panel regulates light intensity to suit the type of copy. **Diebold Inc, 2 West 45th St, New York 19, N. Y.**



Impact Tool E32

ELECTRIC IMPACT TOOL, known as *8U*, is rated to remove studs up to ⅝-in size, drive and remove studs, extract broken capscrews and studs, apply and remove machine screws of all kinds, run wire brushes and drill brick, metal and masonry. It can also be used for tapping and reaming, and for wood boring.

It has all the features and advantages that have made the *4U* model so useful for light maintenance and production work. The reversible motor makes it as easy to remove studs, screws and nuts as to apply them; the motor does not burn out even if spindle stalls. The impact principle operates whenever resistance is met, and provides extra power to push through the job. The new tool is 12⅛ in. long and weighs 9 lb, 13 oz. It is available for either 110- or 220-v current and operates on ac or dc. **Ingersoll-Rand Co, 11 Broadway, New York, N. Y.**

Transformer Test Set E6

UNIT IS DESIGNED to test transformer turn ratio on all types and sizes of power, distribution, and auto transformers in common service. Unit consists of a multi-ratio reference transformer that is excited (by a small hand generator) in parallel with the transformer under test. The reference transformer is adjusted in ratio to equal that of the transformer under test; ratio is read directly from dial switch indexes. Ratios up to 130 may be measured with an accuracy within one part in one thousand. Intended for both shop and in the field, test set is supplied complete with testing leads and weighs about 31 lb. **James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa.**

Mg Battery Charger E13

OCCUPYING less than 4 sq ft of floor space, the *Charg-O-Matic* is furnished as a complete package unit. All electrical connections, relays and other working parts are mounted on a panel within metal cabinet.

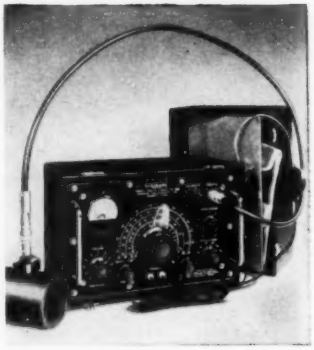
Unit will charge a lead-acid battery in eight hours and a nickel-alkaline battery in seven hours, meeting specification of Electrical Industrial Truck Assn. **Hertner Electric Co, 12690 Elmwood Ave, Cleveland, Ohio.**

Air-Diffuser Cone E38

CONE FITS between outer rim of *Kno-Draft* adjustable air diffuser and ceiling to provide a definite separation between air stream and ceiling. This separation permits anti-smudge cone to keep ceilings free of smudge and allows a greater latitude between face of duct and finished ceiling when installing diffusers. **W B Connor Engrg Corp, 114 E 32nd St, New York 16, N. Y.**

Automatic Clutch E39

FOR APPLICATIONS on electric motors and gasoline engines this clutch automatically connects load to power unit after the latter has started. It is self actuating in either direction of rotation with similar characteristics in both. It may be mounted on horizontal or vertical shafts, and has a sheave for either an *A* or *B* V-belt. Sheave has bore for any shaft diameter of ½ to 1 in. **Clark Clutch Div, Rockford, Ill.**



Thickness Detector E35

MODEL FMSS-5 AUDIGAGE is suitable for nondestructive thickness measurement of steel, copper, aluminum, glass, unfilled plastics and other materials from one side. Typical applications include tanks, pipes, ship hulls, boilers, pressure vessels and sheet metal. Features include adjustable frequency modulation to facilitate the measurement of seriously corroded equipment, special permeability tuning units for increased sensitivity over the whole frequency range, increased frequency range for measuring steel down to $\frac{1}{16}$ in. Special ranges can be provided for thinner materials.

Instrument is portable and battery-operated for field use, but ac power unit can be furnished if desired. An X-cut quartz crystal in the gage head, powered by an electronic oscillator, generates ultrasonic waves, which are transmitted into the material under test.

The instrument is tuned to a frequency

(*Continued on page* 160)

Use convenient reply cards on page 180a to secure additional information on these new equipment items. Please be sure to identify your request with the new-equipment key letter, *E*, and number, as shown on the items above.

Good news about J-M's new Ramie Fiber packing!

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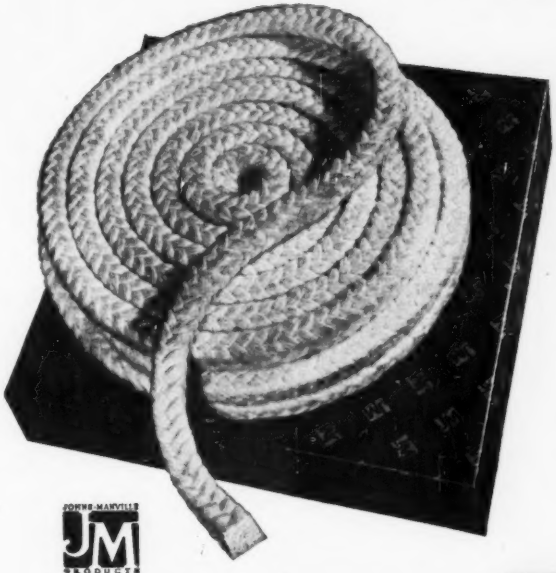
NAVALON IS GOOD NEWS for you . . . because it is made of RAMIE, the strongest of all natural fibers . . . the fiber that actually becomes *stronger* when wet.



GOOD NEWS because Navalon's inherently tough characteristics actually make it highly rot-resistant. Navalon, therefore, performs outstandingly in service against fresh or salt water, brine, cold oil, and many other liquids.

GOOD NEWS because Navalon is abrasive-free . . . *contains* more lubricant . . . and *retains* more lubricant in service. Thus, Navalon reduces shaft wear to a minimum—is ideal for use on pumps, elevators, accumulators, presses and reciprocating rods.

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POWER NEWS

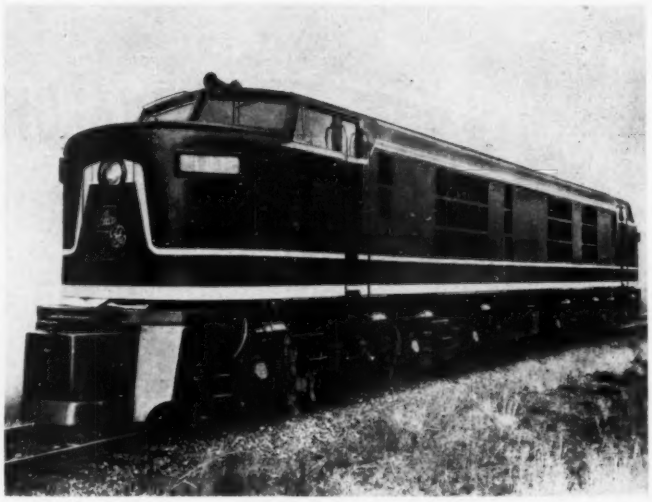
BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

First Gas-Turbine Loco Takes to Rails in U. S.

► THE FIRST GAS-TURBINE electric locomotive to be built and operated in the United States, an Alco-GE 4500-hp unit, began track tests on November 15 at the General Electric plant in Erie, Pennsylvania. After preliminary tests have been completed, the locomotive will be placed in operation on a demonstration basis by the Union Pacific Railroad next spring.

The builders stress development status of the new unit. Lengthy factory and road tests must be conducted before they can obtain any real indications of ultimate success of the gas-turbine powered locomotive. The same gas turbine that was demonstrated in March 1948 at Schenectady, New York, powers the locomotive (See POWER, Aug 1947, pp 68-70, and May 1948, pp 95, 98).

Although the gas turbine currently is fired with bunker-C oil, the builders are hopeful that special research, coupled with experience from operation of this first design, may lead to development of successful means of burning coal in a gas-turbine locomotive. Alco-GE is cooperating with Locomotive Development Committee of Bituminous Coal Research toward that end.



The single-cab locomotive has an operating station in each end. It develops 53 hp per ft of length, weighs 500,000 lb, and has continuous tractive effort of 68,400 lb at 20.4 mph. It is 83 ft 7½ in. long inside of knuckles, 15 ft 4⅞ in. high over cab, and 10 ft 7 in. wide over handrails. Geared for 79 mph, locomotive carries enough fuel for 12-hr operation at 4500 hp.

The gas turbine, operating on simple open cycle, uses 1400-F gas at turbine inlet and drives an electric generator supplying eight traction motors.

Georgia Power Co Starts Work on New Steam Plant

Georgia Power Co has started construction on a new steam-electric generating plant to be named "Plant Yates" in honor of Eugene A Yates, a vice-president of Georgia Power Co and president of Southern Co. Site for the plant is on east side of Chattahoochee River, adjacent to Central of Georgia Railway main line between Newnan and Carrollton, Georgia, and about one-half mile south of main state highway between these two towns.

MacDougald Construction Co, of Atlanta, will handle all excavation and highway and railroad grading. Work on this contract, which is now under way, will be completed early in 1949. The concrete work is scheduled to start early in 1949 and to be completed during early part of 1950.

The plant will be designed for four 100,000-kw 111,111-kva, 13.8-kv turbine-generating units, to be operated by steam at 1250 psi and 950 F total temperature at throttle. First two units for this plant have been purchased from General Electric Co and will be delivered in latter half of 1950. Operation of these two units is scheduled for four months after delivery.

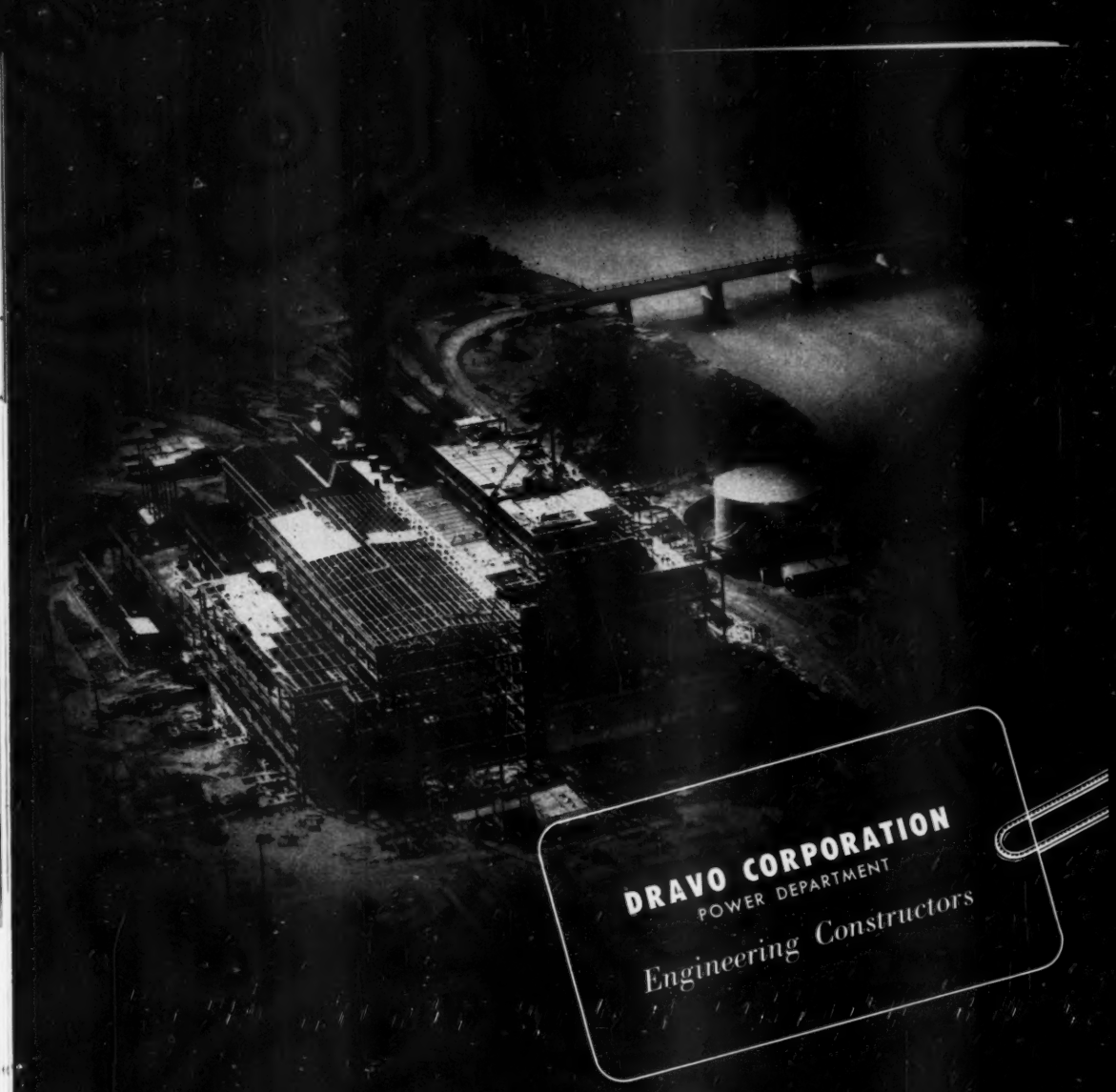
(Continued on page 172)

COMING EVENTS

Jan 10-14—Third National Materials Handling Show, jointly sponsored by American Society of Mechanical Engineers and Materials Handling Institute, Convention Hall, Philadelphia, Pa. Banner & Greif, 250 W 57th St, New York 19, N. Y.

Jan 24-28—International Heating & Ventilating Exposition, International Amphitheatre, Chicago, Ill. Charles F Roth, manager, Grand Central Palace, New York 17, N. Y.

Jan 31-Feb 4—American Institute of Electrical Engineers, winter general meeting, Pennsylvania Hotel, New York, N. Y. H H Henline, secretary, 33 W 39th St. New York 18, N. Y.



The PHILADELPHIA ELECTRIC COMPANY'S new 120,000 kw plant now under construction at Barbados Island, Norristown, Pennsylvania. This is one of several large central station projects now being constructed by the Power Department of Dravo Corporation.

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ENGINEER'S BOOKSHELF

REVIEWED IN THIS ISSUE

REFRESHER NOTES FOR PROFESSIONAL ENGINEER'S LICENSE EXAMINATION • STANDARDS OF THE HYDRAULIC INSTITUTE • POWER FROM THE WIND • MOLYBDENUM—STEELS—IRONS—ALLOYS • FAN ENGINEERING • THERMODYNAMICS • THEORY AND PRACTICE OF HEAT ENGINES • ELEMENTARY STEAM POWER ENGRG • DIRECTORY OF ENGINEERING DATA SOURCES • THE EFFICIENT USE OF STEAM • SCIENTIFIC AND TECHNICAL ABBREVIATIONS, SIGNS AND SYMBOLS

Fan Handbook

FAN ENGINEERING, *fifth edition* (1948). *By Richard D Madison, editor.* 808 *pp*, 4½x7, *illust, tables, charts, cloth.* $6. *Buffalo Forge Co, P O Box* 985, *Buffalo* 5, *N. Y.*

Although designed primarily as a handbook, considerable effort has evidently been devoted to explaining the principles and data in concise form. Many charts and tables for the air-conditioning engineer and other fan appliers are included, with suitable explanations and solutions of sample problems. Since it is impossible to cover all possible fan applications in a book of this size, only the more important are included.

Section headings briefly describe the contents: Part I—Physics of Air, Properties of Air and Air-Vapor Mixtures, Heat Transmission, Fluid Flow, Air Distribution. Part II—Fans, Centrifugal Fans, Axial-Flow Fans, Fan Laws, Testing, Systems, Sound, Fan Dynamics, Fan Power Equipment, Jet Pump. Part III—Fan Applications, Heating, Ventilation, Humidifying, Cooling, Drying, Combustion, Air Cleaning, Exhausing and Conveying. Part IV—Air Conditioning, Equipment Selection, Fan Details, Multiblade Ventilating Fans, Centrifugal Fans, Axial Flow Fans, Heaters, Coolers, Air Conditioners, Evaporative Coolers, Air Cleaning and Humidifying.

Power Engineering

ELEMENTARY STEAM POWER ENGINEERING, *Third Edition* (1948). *By Edgar MacNaughton, professor of mechanical engineering, Tufts College.* 640 *pp*, 6x9½, 497 *illust*, 43 *tables, cloth.* $6.50. *John Wiley & Sons, Inc*, 440 *Fourth Ave, New York* 16, *N. Y.*

The material is intended primarily for men of college grade, but mathematical treatment has been kept sufficiently simple to enable use by vocational schools and general readers. Where possible, practical phases of the subject are presented before the theoretical ones, with the intention of making the basic theory easier to understand. After a brief discussion of thermodynamic principles and properties of air, water and steam, the text is devoted to descriptions of steam-generator components, fuels, coal- and ash-handling equipment, combustion of gas, oil and coal. In addition to the steam-making components the text then describes piping systems, steam engines, steam turbines and their auxiliaries. Considerable space is devoted to description of design details of the various apparatus found in a steam power plant.

THEORY AND PRACTICE OF HEAT ENGINES (1948). *By Virgil Moring Faires, professor of mechanical engineering, Agricultural and Mechanical College of Texas.* 388 *pp*, 6x9, 251 *illust*, 8 *tables, cloth. The Macmillan Co*, 60 *Fifth Ave, New York, N. Y.*

Treatment aims at serving the needs of students taking a short course in heat power. The book emphasizes application of the general energy equation to all forms of equipment working on the principles of energy transformation. Much material from the author's book on *Applied Thermodynamics* has been used. He covers compressors, i-c engines, steam engines and turbines, steam generators, combustion and refrigeration.

THERMODYNAMICS (1948). *By Edward F Obert, associate professor of mechanical engineering, Northwestern Technological Institute, Northwestern University.* 571 *pp*, 6x9, *illust, tables, charts, cloth.* $5.50. *McGraw-Hill Book Co*, 330 *West* 42*nd St, New York* 18, *N. Y.*

The author departs from the conventional presentation of thermodynamics to the college student by including in each chapter more material than would ordinarily be covered in an introductory course. The intention here is to show the student that a much greater field lies untouched than indicated by his assigned lessons, and thereby arouse his curiosity.

It is encouraging to note this book uses the molecular kinetic theory to introduce the subject of gases; this should help the student arrive at a quicker understanding of gas behavior. Another unusual feature is the first chapter on the dimensional system, a treatment usually reserved for introduction to heat transfer and fluid flow. In addition to the usual subject matter a chapter is included on fluid flow and another on thermochemical calculations.

THE EFFICIENT USE OF STEAM (1947). *By Oliver Lyle, member, Fuel Efficiency Committee of the Ministry of Fuel and Power.* 912 *pp*, 6x9½, 438 *illust*, 82 *tables, cloth*, 15 *shillings. His Majesty's Stationery Office, York House, Kingsway, London, W. C.* 2, *England.*

Written for the practical industrial-plant operator in an endeavor to help him reduce plant operating costs by eliminating waste of steam. This book is a companion volume to *The Efficient Use of Fuel*, published in 1944 by the same group. The most advanced math in the book utilizes a pair of simultaneous equations, but of necessity there is a considerable amount of arithmetic. The first three chapters are largely theoretical and serve as an introduction to the main theme. It is definitely not a textbook. Very little space is devoted to design details of boilers, engines, heaters, evaporators, etc. Rather, attention is given to how steam behaves in these devices and how to secure optimum steam consumption.

Some of the chapter headings are: Insulation, Distribution, Measurement, Engine Operation, Traps, Condensate Handling, Air Removal, Heat Transfer, Heat Storage, Multiple Effect Evaporation, Automatic Controls. Naturally, the book emphasizes British practice.

Metals

MOLYBDENUM — STEELS — IRONS — ALLOYS (1948) *By R S Archer, J Z Briggs, C M Loeb, Jr.* 6x9, 391 *pp*, 187 *illust*, 107 *tables, cloth. Available to qualified applicants. Climax Molybdenum Co*, 500 *Fifth Ave, New York* 18, *N. Y.*

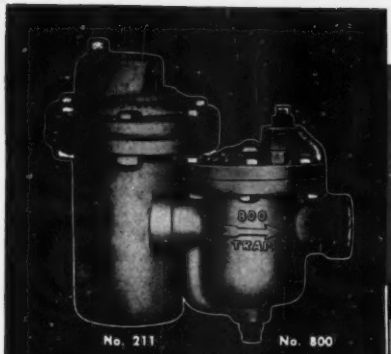
A useful reference work for engineers and designers concerned with properties of metals using molybdenum as an alloying medium. Each chapter has an extensive bibliography. Chapter headings indicate scope of the volume: Technical effects of molybdenum; Fundamental effects of heat treatment on microstructure; Addition of molybdenum, wrought alloy engineering steels, wrought corrosion-resistant steels, wrought steels for elevated-temperature service, tool steels, steel castings, cast iron, special purpose and nonferrous alloys.

Basic Engineering Sciences

REFRESHER NOTES, HYDRAULICS, THERMODYNAMICS, MACHINE DESIGN FOR PROFESSIONAL ENGINEER'S LICENSE EXAMINATION (1948), *by J D Constance, professional engineer,* 175 *pp*, 8½x11½; *illust*, $4.50. *J D Constance*, 625 *Hudson Terrace, Cliffside Park, N. J.*

Here is refresher material on the fundamental concepts, methods and practical applications of basic engineering sciences for engineers planning to take examinations for a professional license. The author uses the text (a comprehensive collection of illustrative problems and solutions com-

(*Continued on page* 144)



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Above left — Armstrong bottom inlet—top outlet series trap.

Above right— Armstrong No. 800 side inlet—side outlet trap.

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PREFAB HOUSE OUTPUT SPEEDED UP by unit trapping with Armstrongs . . . heating time reduced over 50% . . . temperatures 10° higher.— Riverdale Millwork Co., Chicago, Ill.

•

PRODUCTION UP 20% as a result of $300 investment in Armstrong traps.—*Small sugar central in Venezuela.*

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LAUNDRY INCREASES PRODUCTION 150% by unit trapping presses, tumblers, flatwork ironers and unit heaters with Armstrong traps.—*Fame-Penn Laundry, Canton, Ohio.*

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Public Relations = Horse Sense

I've been reading in the papers where many companies have been hiring "Public Relations Experts" at fancy salaries, so I started asking around about the duties and qualifications of these people. I figured I'd overlooked something here, because you don't need a college degree or have to have a trade-school diploma to be a Public Relations Counsel, and the pay is excellent.

It seems that the public relations job consists of advising the top brass on (1) how to get along with the men working for them, and (2) how to get the general public (which means the government, too) to believe the boss is a great humanitarian and his company is a swell outfit. Another way of saying it is that public relations is plain, common horse sense, masterminded by an expert for the boss who is too busy or whose company is so big that he has to get someone else's help in the common-sense department.

The best boss I ever had told me two things early in the game. The first was: "You'll never learn anything with your mouth open," after I had argued with him on several points I didn't know too much about. The second was: "Don't be satisfied just to learn your own job—get to know the jobs of the fellows working to the left and right of you, to the front and rear." By this he meant that if a man is content to become familiar with his own duties, he'll never be ready for advancement when the opportunity comes.

Well, this boss never needed advice from Public Relations Experts—in fact, he could have given them a few lessons. He knew his men, what their ambitions were, their hobbies, their families—and was called on several times to help a man through a rough time at home. Result was high worker efficiency, low turnover of manpower, good relations between all the members of the outfit, who realized each one had a fair and equal chance to move ahead.

Some good men go all the way on the technical phases of their jobs, and become the best steam engineers and electrical men in town. But when a desirable job opens up, they get passed over for promotion in favor of somebody who has learned his ABC's in *human engineering*. The schools and universities are realizing the need for teaching on this subject, because they are paying a lot more attention to the value of writing a decent letter, and making a talk to a group, than they did a few years ago.

Power engineering keeps on getting more and more complex, it seems, as we add more and more knowledge, but let's not ever make it so technically demanding that we neglect the basic art of getting along with the people who work over us, along with us, and under us.

George Edwards

Engineer

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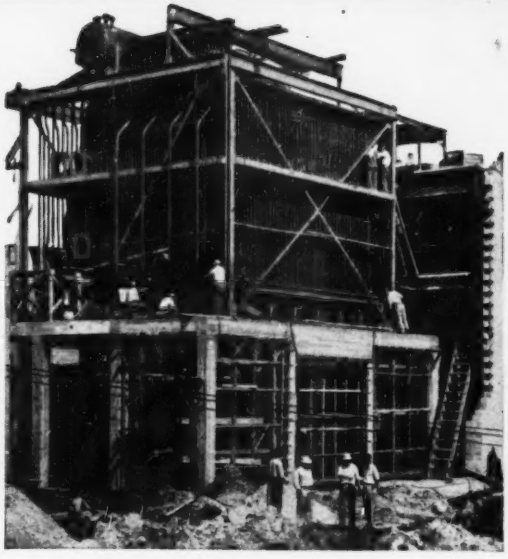

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Electronics

(*Continued from page* 109)

a reactor connected to an ac system. Here we have a water motor with a flywheel connected to a cylinder with a piston, and the system filled with water. If the piston is moved slowly from right to left, water flowing through the motor will drive it and the flywheel counterclockwise. Because of the flywheel's inertia the water and motor do not accelerate in proportion to the force applied to the piston.

This is because part of the energy transmitted by the water is stored in the flywheel; it is what happens in a reactor in an ac circuit. Part of the energy transmitted by the current is used to magnetize the reactor's core and store energy. While the core is being magnetized a voltage is induced in the reactor's coil that tends to prevent current increase, as explained in the Dec 1948 article, p 129.

After the motor and flywheel are running at a good speed we try slowing down the piston. Because of the energy stored in the flywheel the motor tends to continue to run, and builds up a pressure on the back of the piston to keep it moving until the flywheel gradually slows down and comes to rest. In doing so, the flywheel expends its energy to keep the water, motor and piston in motion.

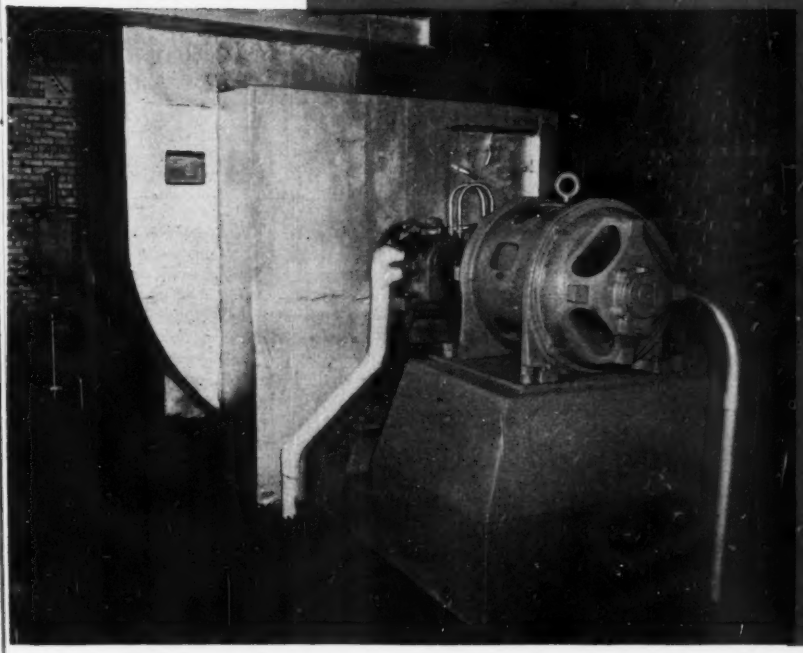
The same thing happens in our electric circuit with the reactor, Fig. 18. If we reduce the voltage the current does not decrease immediately in proportion to voltage reduction. Because, when the current starts to decrease, the magnetic field begins to collapse and induces a voltage in the coil that tends to keep the current flowing, just as the flywheel tends to keep water flowing in the system.

If we reverse the current in the circuit as in an ac system we repeat the cycle of events explained, but in the opposite direction. Similarly, with the hydraulic system, if the piston's motion is reversed the water, motor and flywheel will also be accelerated in the opposite direction. After this process, if the piston is allowed to slow down the flywheel gives up its stored energy to keep the piston in motion until it gradually comes to rest.

Ability of a reactor to induce a voltage in a circuit when the current changes in value is called inductance, as we learned in the Dec 1948 article. Inductance is measured in henrys. A circuit has an inductance of one henry

Upping HORSEPOWER

On Induced Draft Service



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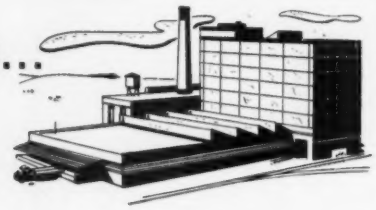
CORAVOL CASE HISTORY NO. 2

2nd in a series describing CORAVOL results in steam systems

Type of Operation...



DAIRY PRODUCTS MANUFACTURE

OPERATING CONDITIONS: Average evaporation 350,000 lbs. per 24 hours.

Make-up — 5%.

Operating pressure, 150 psi.

Steam used for milk processing, evaporating and drying.

PROBLEM: Corrosion in lines of steam system.

CORAVOL STARTED: September 1944.

RESULTS: Complete protection of lines of steam system and no evidences of corrosion by steam or condensate.

USER COMMENTS: No objectionable features to use of CORAVOL in processing operations.

STOP STEAM SYSTEM CORROSION

with **CORAVOL** (the original* AMINE PROCESS)

CORAVOL in your steam system (1) prevents corrosion in lines, (2) cleans out clogging rust deposits. Thus, CORAVOL *protects lines;* improves heat transfer; restores original capacity of lines and efficiency of valves and traps.

CORAVOL is *not* a boiler feed water treatment—it is designed expressly for use in steam systems. Because **CORAVOL** volatilizes and condenses with the steam, it circulates throughout your entire steam system and protects *all* zones from corrosive attack.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special formulas of treatment for: boiler feed water . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply.

*The use of CORAVOL in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

WRITE TODAY for complete *free* data about the CORAVOL process.

WESTERN CHEMICAL COMPANY

713 Washington Street — Kansas City 6, Missouri

when a current change of one ampere per second induces one volt. This is quite a large unit so the millihenry, one thousandth of a henry, is a more convenient unit, and the one commonly used.

We now have assembled practically all the tools necessary to understand electronic circuits. In the next article we will apply them to rectifier circuits.

Electrical Deaeration

(*Continued from page* 93)

chloride, after 3 minutes electrolysis at 3 volts, was found to contain 0.15 ppm of chlorine because of the formation of sodium hypochlorite. With the apparatus described by Rodwell it would probably be easier to get electrical oxidations like this than it would be to induce electrical reduction, particularly as the electrodes of carbon and iron, used experimentally and in the plant, do not have high hydrogen overvoltages.

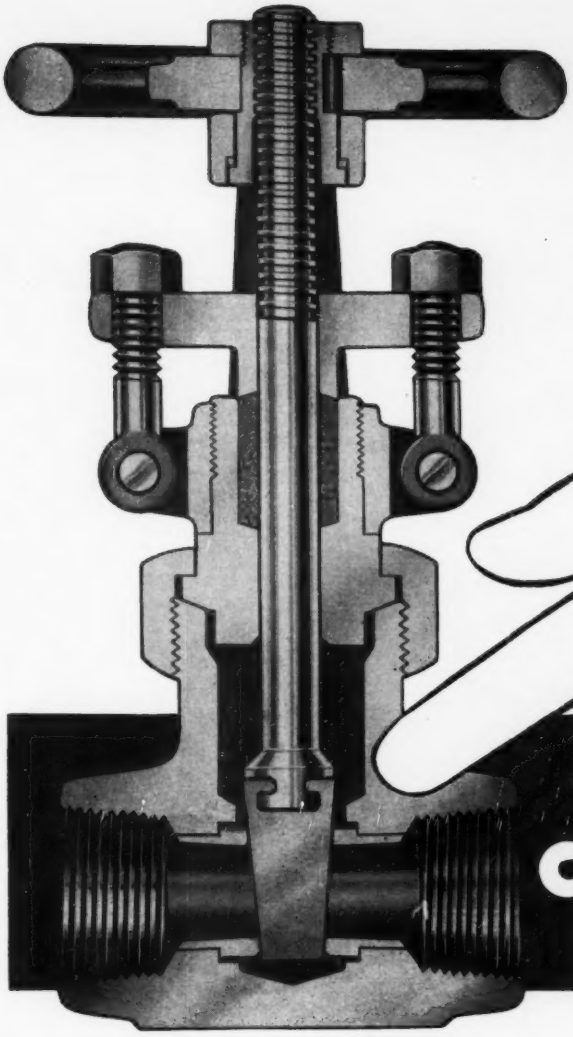
It seems almost certain, therefore, that electrical deaeration at Slough involves an electrolytic reduction of one of the constituents of the water. The reducing agent formed consumes dissolved oxygen in the feedwater. Moreover, this agent seems to leave sufficient residual to react with the iodine released by decomposition of potassium iodide, which normally occurs in a completed Winkler test solution on standing.

Our explanation could be proved or disproved by using Schwartz and Gurney's bi-iodate modification of the Winkler test (American Society for Testing Materials, Proc 34, Part II, 796-820, 1934) to test the electrically deaerated water at Slough. If we are correct in assuming a reducing agent has been manufactured electrolytically, a negative oxygen value would be obtained. This means that the Slough electrical deaeration method is not universally applicable and depends on salts in the feedwater.

Following data from Slough would interest everyone with similar problems:

1. Chemical composition of boiler feed.
2. Areas of electrode surfaces in deaerator.
3. Electrode polarity in deaerator.
4. Results of oxygen tests using Schwartz and Gurney's bi-iodate modification of Winkler method.

Our object, in drawing attention to



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mean years of extra wear

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LONG WEAR is built right into this sturdy Chapman gate valve. Stem, seat rings and plugs, for instance, are made of stainless steel for maximum resistance to corrosion. And for maximum wear resistance discs are not just hardened *but are super-hardened by Malcomizing.*

But that's only part of the story. The body is made of forged steel for extra toughness. And you can repack these Chapman valves under full pressure. These features all add up to longer endurance . . . years more of trouble-free service.

Made in sizes from ¼" to 2" — carbon steel for pressures to 800 pounds and alloy steel for working pressures up to 1000 pounds at 750°F. For higher pressures, specify List 990.

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$31,207.00 Contract Price — $11,707.00 Cash Payment
19,500.00 Deferred Payment — 15,300.00 Annual Earnings

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$14,150.00 Contract Price — $ 1.00 Cash Payment
14,149.00 Deferred Payment — 10,500.00 Annual Earnings

PAINT MANUFACTURER
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22,100.00 Deferred Payment — 16,100.00 Annual Earnings

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● 600 kw. Multi-Cylinder Vertical "Universal Unaflow" Steam Engine

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For Over 75 Years, Doing One Thing Well – Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

the negative results we obtained, is to emphasize our belief that the Slough procedure is not of general application, and the success of electrical deaeration depends on salts present in the feed. If power-plant chemists realize its probable limitations, everyone concerned with deaerating problems will welcome this new angle proposed by Rodwell.

Engineer's Bookshelf

(*Continued from page* 136)

piled from examinations) in evening courses, sponsored by Metropolitan Section engineering societies of New York City. The book covers subjects like hydraulics, thermodynamics and machine design.

STANDARDS OF THE HYDRAULIC INSTITUTE (*8th edition*) 1948. 214 *pp*, 8½x11 *in.*, 151 *illust*, 43 *tables, charts, stiff-paper cover.* $3. *Hydraulic Institute*, 90 *West St, New York 6, N. Y.*

These well-known standards, completely revised after two years of intensive work, are divided into six sections: general, centrifugal pumps, rotary pumps, reciprocating pumps, data, and pipe friction. General section contains introduction to the standards, pump classification and general information.

Each of the three pump sections covers definitions and parts; materials of construction; standards of volume, head, power and efficiency guarantees; suction lift and suction head; positive suction head for hot-water pumps; installation and operating instructions; special applications; test code methods of capacity and head measurements; data and results of tests.

Data section contains friction of paper stock in cast-iron pipes and recommended materials for pumping various materials. Pipe-friction section, issued as a tentative standard, is the result of an investigation to revise pipe-friction data.

The large amount of material, other than that pertaining to recommended standards, makes this edition a comprehensive treatment on pump selection, installation and operation.

DIRECTORY OF ENGINEERING DATA SOURCES (1948) 65 *pp*, 6x9, *paper*. $2.50. *Southeastern Research Institute, Inc*, 5009 *Peachtree Rd, Atlanta, Ga.*

A compact reference bulletin, giving more than 500 sources of published engineering data. These include technical universities and colleges, scientific and trade societies or associations, commercial publishers of books and periodicals, and a roster of Federal agencies engaged in scientific work.

A classified section gives sources of information on aeronautics, meteorology, air conditioning, heating, refrigeration, astronomy, atomic energy, ceramics, refractories, glass, chemistry, plastics, electronics, radio, telephony, geology, instruments,

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Examine the special construction of Ankorite 387-F as shown in cross-cut sectional view. You will see how the resilient core is bonded to the inner braids with a binder which makes the interior impervious to liquid pressures. This permits the soft outer braids to absorb a portion of the liquid and keep it in contact with the plunger or shaft surface, thus insuring liquid film lubrication at all times. Soft lead wires interspersed only in the outer braid, are sufficient to promote low friction contact and protect shaft or plunger surface.

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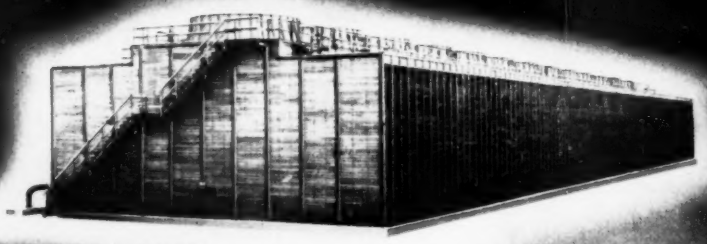


FOR AN ENGINEERED TOWER STRUCTURE

Every Double-Flow Cooling Tower is structurally sound . . . able to give twenty-four hour a day, year around service.

Double-Flow cooling towers have been subjected, during the past decade, to hurricane, earthquake, corrosive atmosphere and other similar tests without suffering a single loss. Here's why:

LUMBER . . . only the finest HEART QUALITY REDWOOD is used. All structural members are properly sized and are free from sapwood that is subject to fungus and insect attack.

HARDWARE . . . heavy bolts are used throughout with ring connectors added at critical joints . . . no nails are used to bear any structural load.

MECHANICAL EQUIPMENT SUPPORT . . . massive, corrosion-free wood crossbeams are used to support the mechanical equipment. Diagonal bracing in this area gives added strength.

COLUMNS . . . vertical columns placed on a maximum of six foot centers. Louver posts are machined to accommodate the continual expanding and contracting slip-fit louvers.

BRACING . . . transverse and longitudinal bracing extending from each six foot height to the bottom of the tower.

Each joint and every detail, as well as the major members of a standard MARLEY DOUBLE-FLOW Cooling Tower are guaranteed against a 30-pound wind. The low, wide design of the Double-Flow gives unusual stability.

To be sure YOUR new cooling tower is STRUCTURALLY SOUND, Specify MARLEY DOUBLE-FLOW!

Ask for a Marley Factory-Trained APPLICATION ENGINEER to tell you more about the MARLEY-DOUBLE-FLOW and its ENGINEERED STRUCTURE. He'll be glad to help you solve your water cooling problems. No cost or obligation.

MARLEY COOLING TOWERS

THE MARLEY COMPANY, INC. • KANSAS CITY 15, KANSAS

No Other Water Conditioning System Has All of These Features...

...ALL IN ONE TANK:

Main treating tank of a Worthington Hot Process Water Conditioning System, capacity 900,000 lb. of treated water per hour

YES, you get all these and more, too, in one tank without the aid of internal mechanical agitation or other moving parts when a water conditioner like this 900,000 lb. per hour Worthington installation treats your make-up or condensate water.

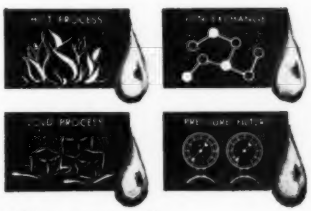
In less space you get all the heating, chemical feeding and clarification facilities to provide optimum water conditioning results. Worthington's engineering skill and complete manufacturing facilities offer you the advantages which can only result from carefully coordinated effort under one responsibility.

WRITE FOR FACTS

For proof that, in water conditioning as in so many other services, *there's more worth in Worthington*, write for Bulletin W-212-B2. *Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, N.J.*

Six pressure filters 11 feet in diameter used for final clarification in this Worthington Hot Process Water Conditioning System

J8-3



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you get a Union that's

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ECONOMICAL
STURDILY BUILT
EASILY INSTALLED

Their two bronze seats, ground to a true ball joint, mean longer service

Dart Unions are different. Their tightness is not derived from an ordinary "jammed" joint, but from two bronze seats ground to a *true ball joint*. They close drop-tight without excessive wrench pressure and open just as easily. What's more, they can be used over and over again in different locations. Both the body and nut are made of high-test, air refined malleable iron and are practically indestructible.

Let your supplier show you Dart's unique construction.

E. M. DART MFG. CO.
Providence 5, Rhode Island

DART
UNIONS

company was asked to use kerosene as the solvent.

The first test was made at Waterside Station in January 1946. The fuel bed was prepared for a normal start, but without the wood bonfire. Pieces of NaPalm gel were spotted at various points on the fuel bed and ignited with a torch. It took about 1½ hr to put the boiler in operation, about the same as formerly. But the test indicated that a much quicker start was possible.

Later in the month a boiler at Sherman Creek Station was started with a modified procedure. The fuel bed was covered with coal for about the first 3 ft of its length. A trench was made in the coal about 1 ft from the throat where the coal feeds into the furnace. The trench ran across the fuel bed and about 5 gal of NaPalm were placed in the trench in the form of a long irregular ribbon. This ribbon was ignited with a torch. The boiler was on the line 26 min later. The normal operating crew handled the entire start, and forced draft was applied nearly from the beginning without extinguishing the fire. A few days later another test was tried with NaPalm, having light fuel oil instead of kerosene as a solvent. This start took about 30 min.

It is believed this short starting period can be reduced with a warm boiler setting. Heat liberation in the furnace is high within a few minutes after the NaPalm is touched off, but it takes time to warm cold boiler settings.

Similar starting procedure was used on one of the 500,000-lb-per-hr boilers at the Hudson Avenue Station, but no attempt was made to shorten starting time. About five gallons of NaPalm were used for starting. As a result of these tests it was decided to use this gel for all stoker-boiler starting.

When it was attempted to prepare a fuel bed with NaPalm long in advance of use, the gel would seep through the coal slowly and disappear completely within a few days. To prevent this, specially treated oil-proof paper was obtained. The paper, laid the length of the trench on the coal, retains the gel for an indefinite period of time.

NaPalm storage presents no difficulties. The same precautions as for light fuel oil prove ample. A limited quantity of the gel is stored in the boiler room, in a special enclosure to prevent its use by unauthorized persons. At present NaPalm costs about $1 a gal.

Iowa Electric Light & Power Co., with headquarters in Cedar Rapids, Iowa, contemplates spending $105,000 on new power-plant and generating equipment at Monticello, Iowa.

Get the pump with all these features:

1. Pump and motor in ONE rigid frame, on ONE shaft, to eliminate alignment troubles.

2. Drip-proof motor specially designed by Allis-Chalmers for efficient pumping service.

3. Bronze wearing rings easily and economically replaceable for long pump life.

4. Generous packing — five or more rings, reduce leakage and frequent servicing.

5. Plastic water seal gives positive control, and requires a minimum of attention.

THE *Electrifugal* PUMP

QUICK INSTALLATION — It's a complete, low-cost pumping "package" — ready to hook up and put into service for a wide range of applications. Can be mounted in any position — fits into close quarters. Made to handle most liquids, with capacities from 15 to 1400 gpm, heads to 500 ft.

HIGH EFFICIENCY — Pump and motor are engineered and built together as a smooth-working team, and Allis-Chalmers takes undivided responsibility for performance. Every Electrifugal pump is run and tested at the factory for efficiency, capacity and head.

IMMEDIATE DELIVERY — Many sizes of Electrifugal, PEDRIFUGAL and SS UNIT pumps are now in stock at convenient points. Phone or wire your nearest Allis-Chalmers office or dealer for latest information on stocks and deliveries. For description of the complete line of A-C centrifugal pumps, to 600,000 gpm, ask for Bulletin B6059D. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 2382

PEDRIFUGAL
The new A-C pump for flexible Texrope V-belt drive. Capacities to 500 gpm, heads to 100 ft.

SS UNIT
Close-coupled pump and motor units, made in 234 standard ratings, to 2500 gpm.

Electrifugal, Pedrifugal, SS Unit and Texrope are Allis-Chalmers Trademarks.

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products

FOR MAXIMUM LIGHT AND VENTILATION

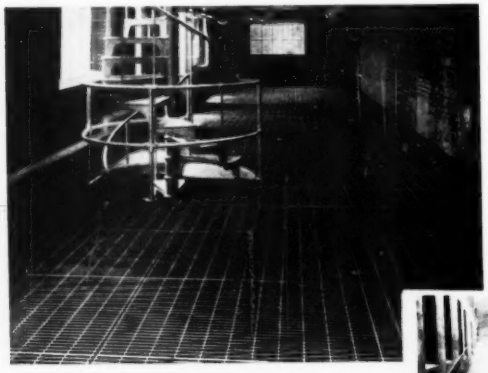
use Hendrick Open Steel Flooring

Its 90% open area offers minimum obstruction to the passage of light from floor to floor—and assures ample ventilation. Its Mitco pressure-formed construction provides rugged, integral panels that will support heavy loads without any lateral deflection. The rectangular, square-edge bars give a thoroughly safe, non-slipping, level walking surface.

There are no bolts, rivets or angle irons to loosen, or to collect dirt and refuse—no welds, liable to have residual stresses and lead to warping.

Hendrick Shur-Site Treads for stairs, ladders and fire escapes, have all Hendrick Mitco advantages. A heavy, flanged nosing-bar, that makes the edge of each tread conspicuous, is an additional safety feature.

For circular walkways Hendrick furnishes Mitco Radial Grating. Hendrick Driveway Grating has extra heavy bars, capable of sustaining the heaviest loads. Where light weight, or corrosion resistance, is of prime importance, Hendrick Mitco grating can be made of aluminum.



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Armorgrids

46 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices In Principal Cities

Plant Problems

(*Continued from page* 116)

Use Cross-Ventilation

RD's SCHEME for cafeteria ventilation is not practicable for the following reasons.

1. Use of 4 exhaust fans, as in original sketch, would create a negative pressure in cafeteria, drawing air from the hot kitchen as well as from tunnel.

2. For proper ventilation of cafeteria, 15 to 20 air changes per hour are recommended. If that amount of air were drawn from the basement through the tunnel and into the cafeteria, an excessive draft would be created near the tunnel doorway.

To properly ventilate cafeteria, 4 propeller-type fans, each capable of delivering at least 5000 cfm, should be installed in upper sash of windows. Keep all windows closed when fans are operating.

Two fans, equipped with motorized shutters located at one end of room, will draw outside air into dining room. Install other two fans with automatic shutters on far side of dining room to exhaust the same amount of air.

If four 24-in. fans are used, each capable of delivering 5000 cfm, approximately 17 air changes will result, which is sufficient for good ventilation. In addition, install an exhaust fan in kitchen to provide 30 air changes per hour.

A draft is usually considered as air moving with a velocity of 50 fpm. or greater. Total cost of above installation should be about $800.

JOSEPH H BECK *New York, N. Y.*

Partition Prevents Draft

REQUIRED NUMBER of air changes for a dining room is between 10 and 20 per hr. Since this cafeteria is crowded for two hours, 20 changes should be used, representing 20x35,757 = 715,140 cu ft per hr, or 12,000 cfm in round figures. If *RD's* uses four fans, each should be rated 3000 cfm.

He should consider two important factors: (1) One or more fans should be installed in the kitchen preventing air flow from kitchen to dining room. (2) If all air is pulled from tunnel, result will be an air velocity of 12,000 ÷ (8x9) = 167 fpm. This is too high for comfort since maximum air velocity striking the body should not be over 50 fpm.

Effect of this high velocity can be reduced by installing a partition in front of dining-room door. One other possible solution is to use two fans exhausting on one side, while two others blow in on the other.

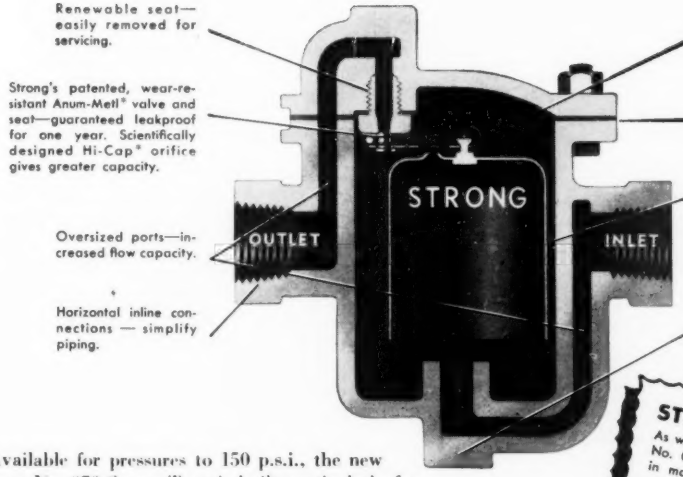
SERGIO MARTINEZ JR *Havana, Cuba*

Three Fans on Each Side

IT IS DIFFICULT to answer *RD's* problem without knowing temperature and relative humidity before and during lunch hours. Nevertheless, it is good practice to provide 25 to 30 cfm of air per seated person in public places. Each occupied seat is considered as supplying 400 Btu per hr, and in

At last...

A SMALL TRAP with all these BIG TRAP QUALITY FEATURES!


Renewable seat—easily removed for servicing.
Strong's patented, wear-resistant Anum-Metl* valve and seat—guaranteed leakproof for one year. Scientifically designed Hi-Cap* orifice gives greater capacity.
Oversized ports—increased flow capacity.
Horizontal inline connections — simplify piping.
Stainless 18-8 high ratio leverage.
Large gasket area.
Seamless, deep-drawn, stainless 18-8 bucket —no welds.
Boss provided for drain connection.
STRONG
OUTLET
INLET

Available for pressures to 150 p.s.i., the new Strong No. 070 Steam Trap is built particularly for small drainage jobs where condensate loads are light, yet where conditions call for the well-known economy of a rugged bucket trap.

Strong's 40 years' experience and rigid field tests have been fully utilized in the development of this fine small trap. It embodies all the quality features of Strong's larger traps, making it your best small trap value.

*T.M. Reg., U.S. Pat. Off.

STRONG GUARANTEE

As with all Strong Semi-Steel Traps, the No. 070 is guaranteed against defect in material and workmanship for one year. Strong's patented, wear-resistant Anum-Metl valves and seats are guaranteed leakproof for one year.

Look at these applications— this trap is especially built for them:

LAUNDRIES—Pressing Machines and Ironers, Tumblers, Dry Room Coils, Starchers, Vacuum Stills, Steam Supply Header

INDUSTRY—Unit Heaters (up to 150,000 btu), Pipe Coils, Tire Recap Equipment . . . *wherever small drainage is a problem*

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HOSPITALS—Sterilizers, Autoclaves

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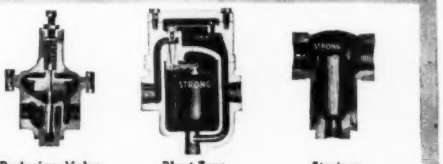
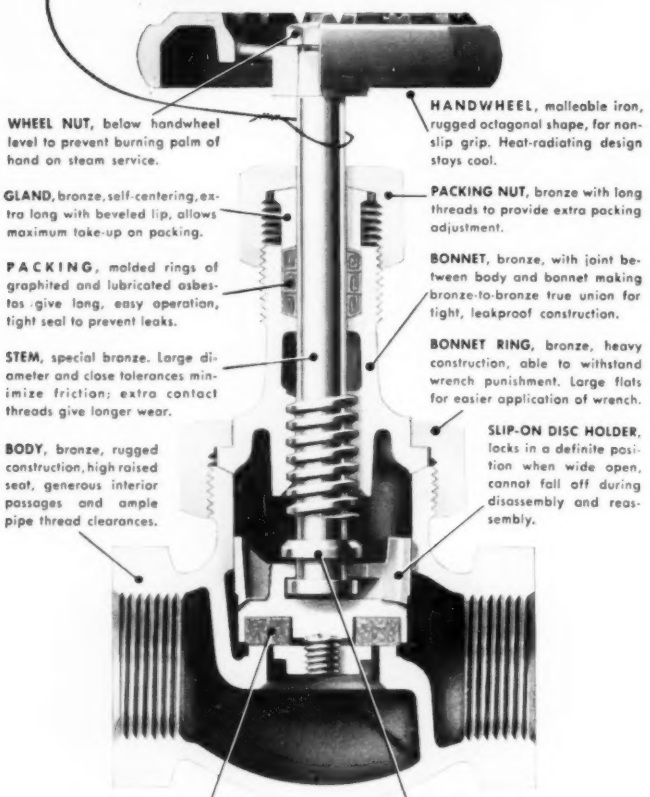
ANUM-METL Reg. Trade Mark



Reducing Valve | Blast Trap | Strainer

Here's WHAT makes this KENNEDY VALVE Better . . . . and WHY!

KENNEDY HEAVY BRONZE GLOBE VALVE (FIG. 89) recommended for services up to 150 pounds steam or 250 pounds water, oil, air or gas. ¼" to 3" sizes available.



WHEEL NUT, below handwheel level to prevent burning palm of hand on steam service.

GLAND, bronze, self-centering, extra long with beveled lip, allows maximum take-up on packing.

PACKING, molded rings of graphited and lubricated asbestos give long, easy operation, tight seal to prevent leaks.

STEM, special bronze. Large diameter and close tolerances minimize friction; extra contact threads give longer wear.

BODY, bronze, rugged construction, high raised seat, generous interior passages and ample pipe thread clearances.

HANDWHEEL, malleable iron, rugged octagonal shape, for non-slip grip. Heat-radiating design stays cool.

PACKING NUT, bronze with long threads to provide extra packing adjustment.

BONNET, bronze, with joint between body and bonnet making bronze-to-bronze true union for tight, leakproof construction.

BONNET RING, bronze, heavy construction, able to withstand wrench punishment. Large flats for easier application of wrench.

SLIP-ON DISC HOLDER, locks in a definite position when wide open, cannot fall off during disassembly and reassembly.

RENEWABLE COMPOSITION DISC, provides perfect seating; asbestos for steam service and special types for various services and temperatures.

BEVELED SHOULDER, makes tight joint with conical seat on underside of bonnet when valve is wide open, for repacking under pressure.

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VALVES • PIPE FITTINGS • FIRE HYDRANTS

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a cafeteria the food and steam tables supply additional heat. When this amount of air per person is supplied at not over 8 to 10 F below cafeteria temperature, and humidity of incoming air complies with seasonal comfort zone given on a psychrometric chart, there will be no objectional draft.

In supplying this amount of air per person 225x25, or 5625, cfm of air is needed for a complete change of air every 6.75 min. With tunnel door of 34.15 sq ft area, an air speed of about 165 fpm is developed.

I recommend *RD* install three fans on each side and have them about 20% larger total capacity than necessary. It would then be possible to stop one or more fans if troubled by draft or when weather is cold. Remember that kitchen fans must be large enough to prevent warm air entering cafeteria when intervening doors are opened.

HARRY E FLOWERS *Chattanooga, Tenn.*

Install Fans in One Wall

ANY ATTEMPT to take continuous air supply from the basement would only result in drawing outside air through it and into the cafeteria. During its brief passage through the basement, air would not be cooled perceptibly.

RD should install three or four 30-in. propeller-type exhaust fans, equally spaced on one side of the room, leaving all windows open. On days when there is not enough natural ventilation to remove heat produced by coffee urns, steam tables, etc. or to dispel the stuffy feeling, put fans in operation.

It would not be practicable from an economical standpoint to install enough exhaust fans to give required velocity for a physiologically cooling effect. Some pedestal fans can be placed in the room for this purpose, but the number of occupants benefited by each fan will be limited.

To answer *RD*'s question as to what is a draft, meaning air velocity necessary to produce an unpleasant sensation, requires knowledge of temperature, humidity and activity of the occupants. Thus, a velocity uncomfortable in a cool atmosphere might be most welcome in warm surroundings. Textbooks on air-conditioning have "effective temperature charts" (many originally published by ASHVE) giving relation between air temperature, humidity and velocity, as influencing human comfort.

A THOMPSON *Atlantic City, N. J.*

Remove Cooking Heat

AN AIR CHANGE every two minutes is best for the low ceiling in *RD*'s cafeteria. Food-service counter along kitchen wall is presumably equipped with coffee urns, steam tables, etc. Heat and vapors given off by this equipment should not be allowed to enter table area. It is suggested that fans and canopy be provided, for area above equipment, to exhaust fumes to outside.

Install at least two propeller exhaust fans, preferably above coffee urns. If grease is present use blower exhaust fans. Each fan should have a 10,000-cfm exhaust volume. Replace exhausted air by partly

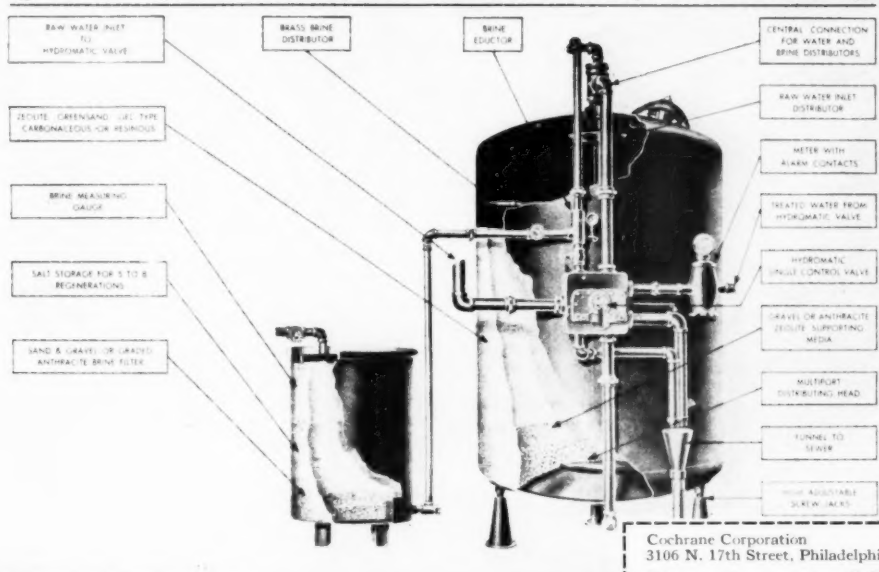
THE VALVE THAT MAKES ORDINARY ZEOLITE SOFTENER AND FILTER EQUIPMENT OUT-MODED

THE introduction by the Cochrane Corporation of a remarkable single control valve as standard equipment on its well-known Zeolite Softeners and on its Pressure Filters makes the operation of the ordinary softener and filter system seem far out-moded. This Cochrane Hydromatic Single Control Valve speeds operations and insures accuracy of operation by integrating the functions of the usual valve nest in one single valve with four normal operating positions and two standby positions. All actions of the valve are smooth, positive and free from shock and the single lever turns with ease. Power is provided by the raw water itself through a pilot valve.

May be arranged for manual or automatic operation

COCHRANE CORPORATION • PHILADELPHIA 32, PA.

Cochrane Zeolite Water Softener with Hydromatic Single Control Valve


RAW WATER INLET TO HYDROMATIC VALVE
BRASS BRINE DISTRIBUTOR
BRINE EDUCTOR
CENTRAL CONNECTION FOR WATER AND BRINE DISTRIBUTORS
RAW WATER INLET DISTRIBUTOR
METER WITH ALARM CONTACTS
TREATED WATER FROM HYDROMATIC VALVE
HYDROMATIC SINGLE CONTROL VALVE
GRAVEL OR ANTHRACITE ZEOLITE SUPPORTING MEDIA
MULTIPORT DISTRIBUTING HEAD
FUNNEL TO SEWER
ZEOLITE (GREENSAND, GEL TYPE CARBONACEOUS OR RESINOUS)
BRINE MEASURING GAUGE
SALT STORAGE FOR 5 TO 8 REGENERATIONS
SAND & GRAVEL OR GRADED ANTHRACITE BRINE FILTER

Cochrane Corporation
3106 N. 17th Street, Philadelphia 32, Pa.

Please send us a copy of Publication 4460 describing Cochrane Hydromatic Valve.

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Catawissa UNION and VALVE dependability means LOWER MAINTENANCE COSTS ... with an EXTRA margin of safety!

HOT FORGED STEEL AND STAINLESS STEEL UNIONS

STANDARD
1/8" TO 3"
Cold-Working Pressure up to 2,000 pounds.

DOUBLE EXTRA HEAVY
1/8" TO 2"
Cold-Working Pressure up to 6,000 pounds.

The Catawissa seat design gives you a perfect seal for every installation -- even when the pipe is not properly aligned -- with its 55-degree angle on the female end to a ball on the male end!

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ESPECIALLY ADAPTED FOR HIGH TEMPERATURE & HIGH PRESSURE SERVICE!
For boiler injection--engineered to outlast the boiler! Efficient, easily accessible!

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opening the windows and tunnel door.

In *RD's* installation, drafts result if air velocity removes a greater amount of heat (evaporation) from body than it is accustomed to at any given temperature.

To keep kitchen odors out, the kitchen should have more exhaust than cafeteria.

H M NOBIS *East Cleveland, O.*

Free-Piston Engines

(*Continued from page* 81)

out by the pump beforehand and stored under pressure. Duration of injection, etc. are controlled by pressure of accumulated fuel, amount to be injected and area of nozzles.

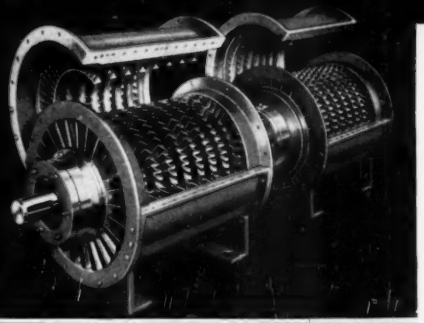
In the Pescara design, an accumulator-type pump supplies six nozzles spaced evenly around the cylinder circumference at the center. Four of these inject directly while two, on opposite sides, inject into precombustion chambers. Only about 5% of the fuel is so injected and the chambers contain only about 10% of main-combustion chamber volume at full load. Gas issuing from the precombustion chambers, in the course of direct injection from the other nozzles, produces a rotational swirl.

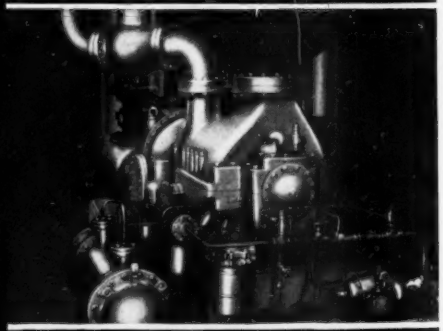
TEST RESULTS. During March 1948, acceptance tests were conducted on a gas producer of 8.5-in. engine bore, 23.2-in. compressor bore and 11.4-in. stroke. At 613 cycles per min, output was 1357 hp (adiabatic heat drop in gas produced), specific fuel consumption was 0.338 lb per hp hr, and thermal efficiency was 41.15%. Mean piston speed ran 1780 fpm and compression pressure came to about 1080 psi. A little over 19% of heat in the fuel went to cooling water. Acceptance test lasted 17 hours. Before this, several endurance runs were made; two of 1000 hr each were run at 850 and 1000 hp.

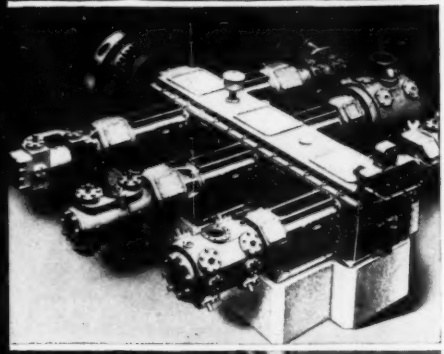
GOVERNING. For a complete plant, with associated turbine, load control is effected entirely at the gas producer, by lowering exhaust-gas delivery pressure and adjusting its quantity. Even with a single producer, turbine output can be adjusted within a wide range. Speed governor of turbine regulates fuel delivered to the producer. With a single producer, part of gas must be exhausted to atmosphere if output drops to less than 17% of full load.

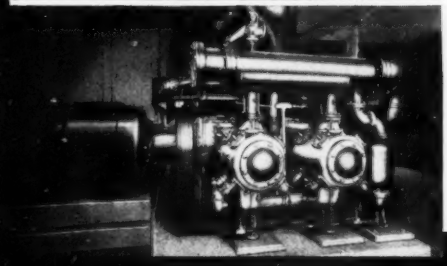
Because gas output from a single producer fluctuates it is desirable to provide some means of equalizing pressure ahead of the turbine. This can be done, witho arge receivers, by connecting two or more producers to

Cut Costs with these CLARK COMPRESSORS









CLARK AXIAL FLOW COMPRESSOR—Clark Axial Flow Compressors are high-capacity, high-efficiency machines, especially valuable in the volume range of 20,000 to 300,000 CFM. Adiabatic efficiencies up to, and frequently in excess of, 85 per cent are available in industrial units.

These units are suitable for either electric motor, steam turbine or gas turbine drive. Gas turbine drives, reflecting the most recent developments in design and research, are built by Clark Bros.

CLARK CENTRIFUGAL COMPRESSOR—Clark Steam-Turbine-Driven Centrifugal Compressors are designed for direct drive by steam turbines operating either non-condensing or at high vacuum. They meet power requirements up to 25,000 BHP and speeds as high as 12,000 RPM.

This compressor is also available as an electric motor-driven unit or as a gas-engine-driven unit, through a standard speed increasing gear.

ELECTRIC-DRIVEN RECIPROCATING COMPRESSOR—Compact in design, the Clark Electric-Driven Compressor requires a minimum of floor space. Smooth operation and low maintenance cost are assured by its balanced-opposed design. All component parts are so constructed as to make the unit adaptable to a wide range of services such as synthetic ammonia, ammonia refrigeration, natural gas booster plants and many others.

Clark Electric-Driven Compressors are built in three different classes:

The CMA (8" stroke—600 RPM) with 2, 4 or 6 compressor cylinders and a horsepower range from 150 to 600 BHP.
The CRA (14" stroke—300 RPM) with 2, 4 or 6 compressor cylinders and a horsepower range from 500 to 2000 BHP.
The CBA (17" stroke—300 RPM) with 4, 6 or 8 compressor cylinders and a horsepower range from 1750 to 4500 BHP.

ELECTRIC-DRIVEN SOOT BLOWER—Recent developments in soot blower equipment prove the economy of using compressed air furnished by electric-motor-driven compressors as a soot-blowing medium. The Clark CTMA-3, with an 8" stroke and operating at 600 RPM, is an ideal unit for this service, because of its high piston displacement and minimum floor space requirement.

Boiler make-up is reduced from 1½% required by steam blowers to less than ½% with the Clark Soot Blower. Energy consumption, as measured by the coal pile, is reduced by 6.5 tons of coal per day.

The Clark Soot Blower Compressor, rugged yet simple in construction, is designed for inherent running balance with trouble-free service over long periods of continuous operation.

Send for complete information on these moneysaving units.

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Clark Bros. Co., Inc., Olean, New York
Please send information on
- ☐ Axial Flow Compressor
- ☐ Centrifugal Compressor
- ☐ Electric-Driven Reciprocating Compressor
- ☐ Electric-Driven Soot Blower

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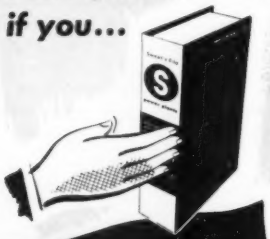

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When you need specific information on materials or equipment, reach for your Sweet's File for Power Plants (the big red file). It contains 118 manufacturers' catalogs full of useful information on thousands of products...from absorbers—gas, to zeolite. Cross indexing speeds finding.

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exhaust into a common turbine. Even with engines of identical design, equally loaded, speeds of the separate engines (cycles per minute) vary by a certain amount so some equalization of pressure can be expected. It is usually desirable, however, to provide some definite means of displacing the phases of two or more producers. This is accomplished by a control apparatus in a pressure-equalizing pipe connecting the air cushions of the two units.

Atomic-Power Studies In Saratoga County

The U. S. Atomic Energy Commission will acquire 4500 acres of land in Saratoga County for an experimental atomic-power plant—part of the facilities of Knolls Atomic Power Laboratory operated for the Atomic Energy Commission by General Electric at Schenectady. The new Knolls reactor is one of two new units being designed especially for study of high-temperature operation and power production. A different type of reactor, but for a similar purpose, is planned by Argonne National Laboratory near Chicago. These will give data for future power plants and help solve the problems involved in "breeding" nuclear fuel. New installation is about 18 miles north of the Knolls Atomic Power Laboratory facilities. The site is well supplied with water and power, and has foundations suitable for heavy concrete structures.

Operation of the reactor will involve production and handling of radio active materials, carried out in a closed-cycle process that does not permit escape of radioactive particles or dust.

Virginia Electric & Power Co has asked the Federal Power Commission for a license to build an $18,000,000 dam and power plant on the Roanoke River. The structure would be erected at the site of an existing diversion dam at head of Roanoke Rapids in North Carolina. The power house would contain three 28,000-hp and one 14,000-hp generating units. The dam would create a reservoir extending about 7½ miles upstream.

City of Clear Lake, Iowa has awarded a contract to Dobson Brothers Construction Co, Lincoln, Neb., at $254,460 for waterworks improvements to include a water-treatment plant, treatment equipment and auxiliaries, electric wiring, etc. Stanley Engrg Co, Muscatine, Iowa are the consulting engineers.

G. L. Tuve, president of American Society of Heating and Ventilating Engineers, has been appointed chairman of the advisory committee for the Ninth International Heating and Ventilating Exposition, which is to be held in the International Amphitheater, Chicago, Jan 24-28. The exposition is under the auspices of ASHVE in conjunction with its 55th annual meeting.

CONTROL

Scale and Corrosion in Power Plant Equipment

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Newly Perfected

Water Conditioning Chemicals

Recently developed applications of the newer colloids and surface-active agents in Wright Chemicals for power plants result in **improved** water conditioning—**positive** scale and corrosion control. Wright Chemicals contain 100% soluble, available chemicals—no waste or inert matter—insuring increased operating efficiency and reduced cost.

Boiler Water . . .

Corrosion and scale-forming compounds in boiler water can be controlled with Wright Chemicals.

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Steam and condensate lines can be properly protected by using Wright recommended formulas.

Cooling Jackets . . .

Efficiency of cooling jackets can be substantially increased by preventing corrosion and scale deposits on heat transfer surfaces.

Wright improved chemicals are the result of intensive study and research by men with years of experience in the development, production, application and control of water-conditioning chemicals.

Wright has no one cure-all to solve all problems. Each receives individual treatment. The Wright field engineer, who will call on you upon request, will obtain all necessary information and samples for examination in the modern Wright laboratory. Analyses are interpreted in view of supplemental information received, and recommendations made in the form of a proposal. Clients are provided with regular laboratory service as a periodic check upon conditions.

There is a Wright Field Engineer near you, anxious to help solve your scale and corrosion problems. No obligation.

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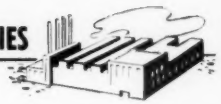
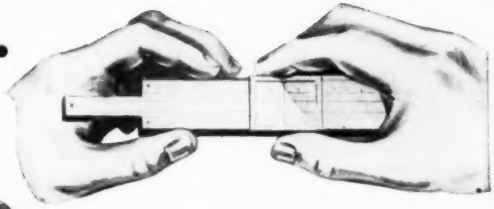
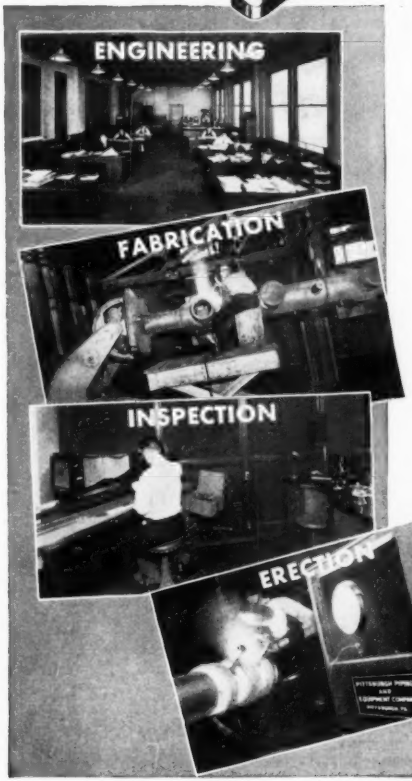


No Matter How You Figure It...



...It Pays to Turn the Complete Piping Job Over to P. P. & E.



Whether you look at it from an engineering or management viewpoint, it pays to entrust the complete responsibility for your power piping installation to Pittsburgh Piping and Equipment Company.

It pays because you obtain the advantages of a distinctive engineering technique, specialized manufacturing facilities, broad experience in diversified piping applications, and skill in meeting and solving present-day erection problems.

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Below are listed **six** of the many Schramm models, portables ranging from 20 to 420 cu. ft. of actual air, the stationary ranging from 2 to 600 cu. ft. displacement.

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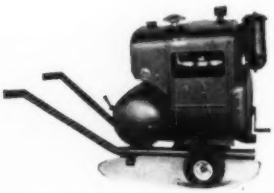
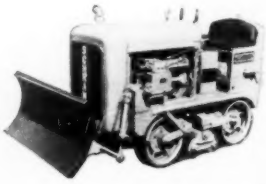
Features you get in Schramm are: 100% water cooled, assuring ideal performance summer and winter; mechanical intake valve, forced feed lubrication, and electric-starter starting. All Schramms are compact, lightweight, easy to operate.

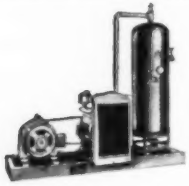
We invite you to write today for fully illustrated catalog describing in detail each of the Schramm Air Compressors shown here . . . plus a wide range of other models. We feel the Schramm story is a good one, and offers you a sure way to get your many compressed air jobs done quickly, efficiently, and economically.



No. 20 Compressor on Shop Truck

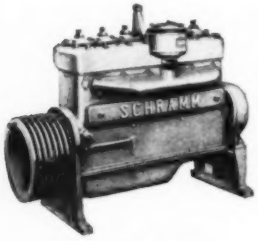


Self-Propelled with Hydraulic Backfill Blade

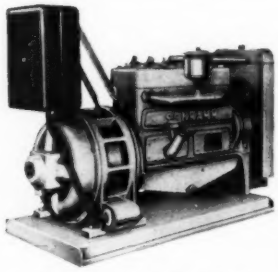


V-Belt Drive with Cooling Unit

Built-in Motor with Cooling Unit



"V" Belt on Flat Pulley Drive



Built-in Motor Drive with Cooling Unit and Starter

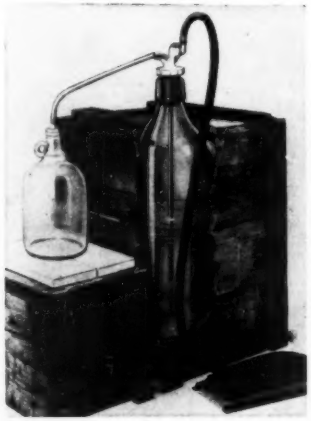
SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER • PENNSYLVANIA

New Equipment

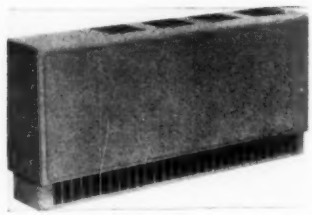
(*Continued from page* 132)

which produces resonance in the unknown thickness. Frequency at which resonance is indicated can be converted to thickness by use of a conversion scale on the instrument panel. The thickness reading obtained is the actual wall thickness of the material directly under the crystal; back-up liquids or scale deposits are not measured. **Branson Instruments, Inc, Joe's Hill Rd, Danbury, Conn.**



Acid Pump E40

SAFE AND CONVENIENT TRANSFER of acids and other liquids from carboys, barrels or drums can be made with this foot- or hand-operated pneumatic pump. Liquid flows smoothly, stops instantly and comes in contact with the corrosion-resisting tube only, and cannot affect other parts. No tilting of the container is necessary, which greatly reduces danger of a slip, splash or spill. **General Scientific Equipment Co, 2700 W Huntingdon St, Philadelphia 32, Pa.**

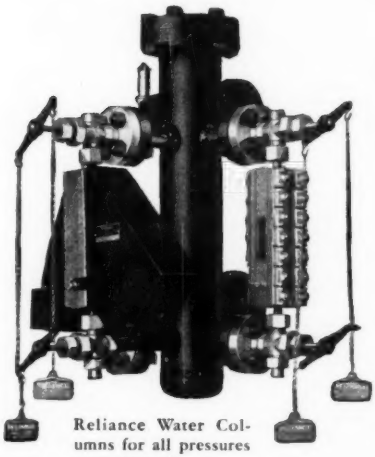


Unit Heaters E41

CABINET-TYPE, hairpin circuit heating system uses nonferrous copper tubing and aluminum fins with supply and return headers on one end and return bends at the opposite end. Series *R* unit heater can

Guard Your Power

with Reliance Safety Water Columns and Gages

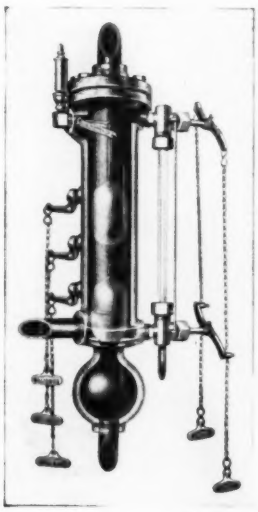


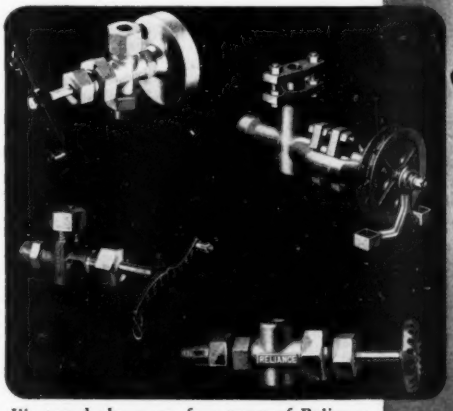
Reliance Water Columns for all pressures up to 2000 lbs.

• In spite of careful employee training and frequent warnings, low water level is still a common cause of serious boiler damage. Guard against power interruptions with ample means of checking water levels—even to having *extra* checks and signals to guarantee instant attention to approaching dangerous conditions.

Reliance Boiler Safety Devices include all the elements of safe water level supervision. Known the world over for sturdiness, accuracy and dependability, Reliance ALARM Water Columns are available for any pressure, and gage equipment to suit every water level checking need. Recently added are electric signal-actuating devices for main boiler and other water-containing vessels . . Reliance Representatives in all principal cities willingly help you to select the most suitable equipment for your needs.

Remote reading water level indication, so you can have a handy, easy-to-see gage on your instrument panel, is provided by Reliance EYE-HYE. Write for Bulletin—mention your working pressure.





Illustrated above are four types of Reliance Gage Valves. At right (center) Prismatic Gage Insert; also single and double-window Mica-Protected Flat Glass Inserts.

BOILER SAFETY DEVICES since 1884

Reliance

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COLLECTION

that ol' debbil

fly ash and how to trap it is the subject of Buell's 32-page catalog on fly-ash collection. It tells you why only Buell offers you a *fractional* efficiency guarantee. It's the only kind of guarantee that *accurately* and *reliably* predicts fly-ash collector performance. The performance figures are often surprisingly high, for the Buell system has the patented van Tongeren 'shave-off'. It's an efficiency 'plus' found only in Buell's large diameter, non-clogging cyclones. Don't miss this factual booklet on planning fly-ash collection installations. Write today to the Buell Engineering Company, 10 Cedar Street, New York 5, N. Y.

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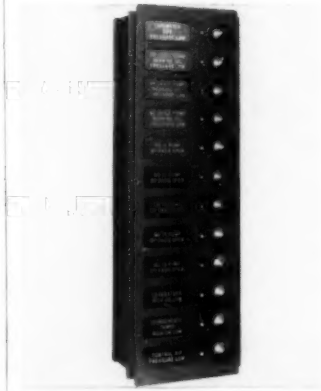
Engineered Efficiency in
DUST COLLECTION

handle steam or forced-water circulating systems and has a constant-speed motor, driving a forward curved blade fan through a V-belt. **Warren Webster & Co, Camden, N. J.**

Gear Lubricant E44

KNOWN AS Keystone grease No. 32, this new lubricant is equally effective through a wide range of temperatures, retaining its plasticity, tenacity and density from sub-freezing cold to its melting point, which exceeds 400 F.

Packed in rigid paper cartridges that fit into specially designed gun applicators, grease is fed through nozzles in a broad ribbon, assuring its reaching pressure side of gear teeth. **Keystone Lubricating Co, 2128 Lippincott St, Philadelphia 34, Pa.**



Annunciator E45

TYPE ANF ANNUNCIATOR has been redesigned to the new width, single gang style. Featured in the *ANF(S)* is its unit method of construction. Each unit designated has

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Dependable Steel Pipe
The Pipe-Fitters Friend

FOR 45 years, Youngstown Steel Pipe has served plumbing and heating contractors dependably--enabling them to furnish adequate water and heating systems to customers at lowest cost.

Whether you use a few feet or thousands of miles of Youngstown Steel Pipe, you can depend on its uniformity--uniform in metallurgical and chemical properties for easy, accurate bending, cutting, welding and threading--uniform in diameter and roundness--cut to uniform lengths--uniformly smooth inside for minimum friction--in short, *uniformly satisfactory.*

QUALITY V YOUNGSTOWN SERVICE

Youngstown STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

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General Offices — Youngstown 1, Ohio

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PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES.

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The better informed you are on newest equipment—latest advances and trends—the more expertly you can plan and apply efficient, economical installations for heating, ventilating and air conditioning in all types of industrial plants. You'll get more helpful information, more profitable ideas here than in any comparable way or time.

A great opportunity for plant officials, architects, engineers and operators responsible for providing and maintaining heat, ventilation and conditioned air in any branch of industry to supplement their working knowledge—to revitalize thinking—to stay progressive. You can't afford to miss it . . . . . note the date and plan now to attend. It will be time well spent.

Management International Exposition Company

a metal slide mounting, two main lamps, a pilot lamp and control relays. Each unit is jack-connected to the circuit to facilitate withdrawal from annunciator cabinet without disturbing permanent wiring connection. Device operates on any standard voltage and may be furnished for ac or dc. **Autocall Co, Shelby, Ohio.**

Sink-Line Cleaner E46

GEAR TRAIN, mounted on hardened and ground shafts rolling in needle bearings, works with a *Rota-Tilt* cable container to give sewer cleaning up to 100 ft of ½-in. sewer cable. When motor unit is detached it acts as a slow-speed drill. **Spartan Tool Co, 6007 North Lincoln Ave, Chicago 45, Ill.**

Pressure Cells E47

SR-4 FLUID PRESSURE CELLS, available in ranges from 0 to 200 psi, can be used in any gas- or liquid-pressure system. Resistance wire-strain gages, bonded to the outside wall of this tube, are stretched when pressure expands the tube, thus increasing their electrical resistance. This change in

accuracy

ROCKING CONTACT

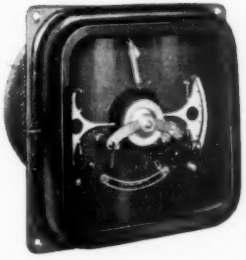
with Allis-Chalmers ROCKING CONTACT Generator Voltage Regulator

THEY'RE precision-built like fine watches. Contact sectors are supported in jeweled bearings . . . rock on carefully machined commutator segments heavily plated with silver for reliable, long-life accuracy.

And the Rocking Contact principle offers you instant response . . . low maintenance, too. The regulator operates directly in the exciter shunt field circuit . . . without time-wasting relays. Complex adjustments, vibrating contacts, gliding friction have all been eliminated to help reduce your maintenance problems.

Rocking Contact Regulators are available for both a-c and d-c generators of any size and speed, for either parallel operation or unit control. Call our representative in your nearby A-C office or write direct. A 2584

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.



Type 366 *Rocking Contact* Regulator. Hinged glass front door allows easy inspection of moving parts.

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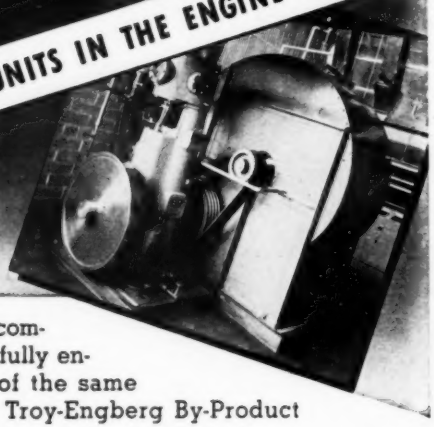
STEAM ENGINE

By-Product Power

1 POWER for your stokers, generators, pumps, compressors

2 HEAT UNITS IN THE ENGINE EXHAUST



And both accomplished by skillfully engineered use of the same steam. This is Troy-Engberg By-Product Power at work.

Use the modern Troy-Engberg Steam Engine to drive stokers, blowers, fans, compressors, mixers, generators and pumps—THEN use the exhaust from the engine for your processing or heating, or both.

Cut Power Costs by putting your steam fully to WORK. Write us for detailed information on applying Troy-Engberg By-Product Power to your plant.

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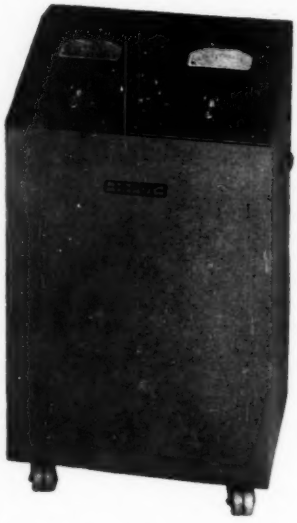
resistance may be measured electrically at a remote indicator or to be used to actuate a control or trip relay.

Calibration accuracy is within plus or minus ¼% of full range. Only a 4-v supply is required. Other available ranges are 0 to 200, 500, 1000, 2000, 5000, 10,000, 20,000 and 50,000 psi. **Baldwin Locomotive Works, Philadelphia 42, Pa.**

Voltage Stabilizer E48

RATED AT 15 WATTS, this unit is suitable for an input frequency range of 57 to 63 cycles, input voltage of 95 to 125 v and output voltage of 115. The output is stabilized to plus or minus 1% for both line and frequency regulation.

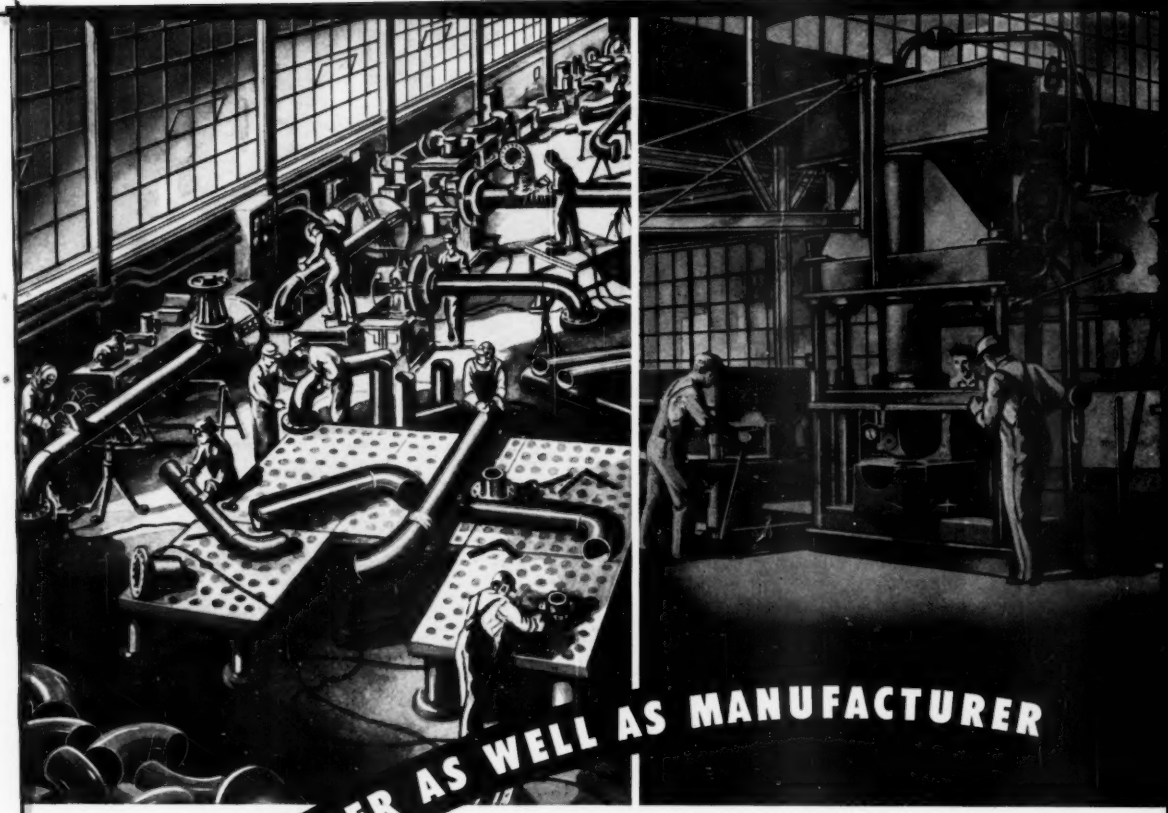
Oil filled for high cooling efficiency, this compact unit is designed for maximum resistance to shock and vibration. Mechanical features include stainless mounting studs and hermetically sealed terminals. **Raytheon Mfg Co, Waltham, Mass.**



Insulation Tester E51

MODEL 2415 INSULATION TESTER is a compact unit using a rectified and filtered high voltage supplied from a specially designed oil immersed high-voltage transformer. It is equipped with an extra long scale indicating instrument. Also on the control panel is mounted high voltage control, the ac line, and high-voltage switches with their indicating lamps. A pair of 5-ft flexible high-voltage detachable test leads are attached to terminals within the case and are brought out through lower back panel. An 8-ft ac line cable, equipped with a ground lead, is also brought out through the panel.

The tester is designed for heavy-duty research development and also for use where it is required to know the breakdown voltage and testing insulation of insulating materials, compounds and liquids. It tests insulation of heavy industrial equip-



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MIDWEST

HAS THE "Customer's Viewpoint"

ON PIPE WELDING FITTINGS

The four Midwest pipe fabricating plants, and the Midwest Contracting Department are among the large users of Midwest Welding Fittings.

Hence, we have the "customer's viewpoint" when it comes to welding fittings. We know from our own experience what characteristics welding fittings must have to simplify piping layout . . . to reduce welding time . . . to improve piping design. The welding fittings manufacturing department always has the benefit of our extensive user experience.

This situation is one important reason for the high quality and exceptional practicality of all Midwest Welding Fittings. Also important are the laboratory control of manufacturing procedures and the program of continuous research in piping and welding problems.

For more information about Midwest Welding Fittings, get in touch with the local distributor or our nearest office.

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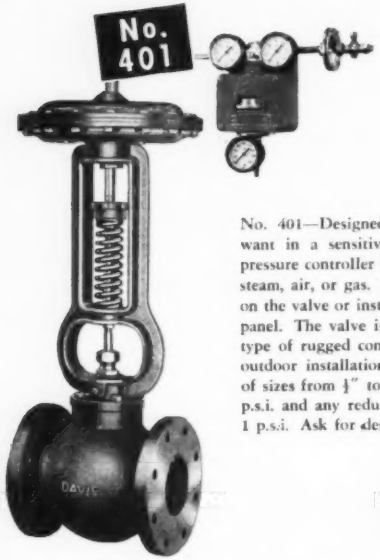
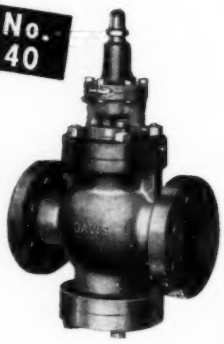
WELDING FITTINGS IMPROVE DESIGN AND REDUCE PIPING COSTS

—everything YOU want in
PRESSURE REGULATORS

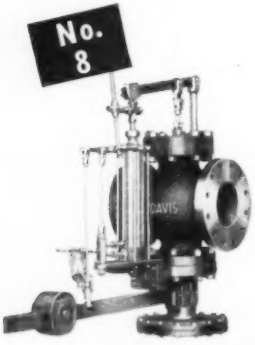


The DAVIS Line is Complete!

No. 401—Designed to give you everything you want in a sensitive diaphragm motor valve and pressure controller for pressure reducing service on steam, air, or gas. The controller may be mounted on the valve or installed remotely on an instrument panel. The valve is a spring loaded, balanced disc type of rugged construction suitable for indoor or outdoor installation. Offered in a complete range of sizes from ¼" to 10" for initial pressures to 600 p.s.i. and any reduced pressure from 500 down to 1 p.s.i. Ask for descriptive literature.



No. 40—This is a simple, self-contained, pilot operated type reducing valve for handling heavy, variable loads on steam or air. Unaffected by high pressure fluctuations, pressure reduction is maintained regardless of flow conditions. Full pipe size port area gives large capacity; single seat insures tight closing. Sizes from ½" to 6". **Available in** materials suitable for any initial pressure up to 400 p.s.i.



No. 8—Built for handling steam at pressures ranging as high as 600 p.s.i. Pilot controlled and weight loaded, with auxiliary operating cylinder, this valve provides exceptionally accurate regulation for reduced pressures from 0 to 300 p.s.i. Sizes from 2" to 24".

Let Davis help you get the right regulator for the job. The Davis line is complete . . . 18 types to choose from . . . ask for Bulletin No. 100 A.

DAVIS REGULATOR COMPANY
2540 So. Washtenaw Ave., Chicago 8, Ill.

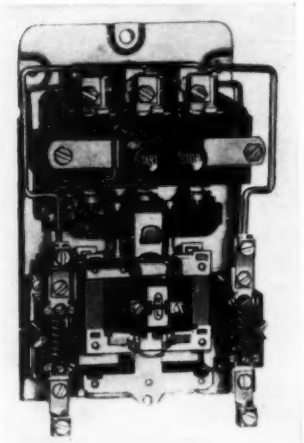
ment such as cable assemblies, conductors, capacitors, windings, transformers, etc. **Cole Instrument Co, 1320 S Grand Ave, Los Angeles 15, Calif.**

Current Transformer E10

Model 313 instrument current transformer is compensated for phased angle and ratio error; they increase current ranges of wattmeters, watthour meters, and other instruments requiring compensated transformers. Transformer shown is insulated for 4500 v, ac, and may be used on 25 to 133 cycles. Units are available in ratios from 25/5 to 1000/5 amp. **Associated Research, Inc., 231 S Green St, Chicago 7, Ill.**

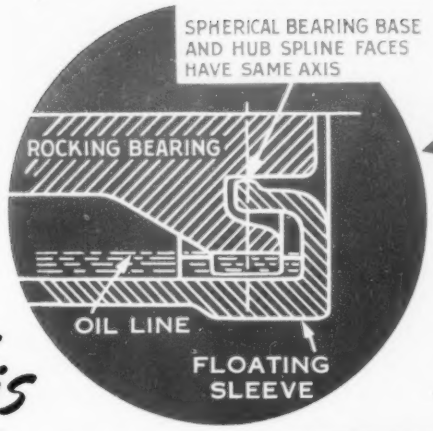
Case Hardening E42

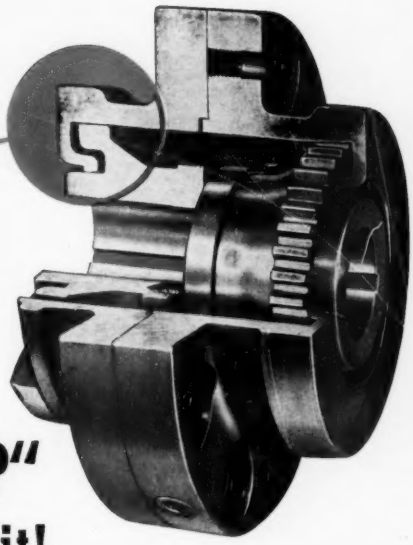
Paste-form case hardening chemical, *Carburit*, is applied to the surface to be hardened, and the work heated to about 1700 F. Manufacturer says a case 0.010 in. thick forms in 5 to 7 min. After heating, the work is cooled and reheated to 1500 F when the paste is knocked off and the work quenched. **Denfis Chemical Laboratories, Inc, 172 Pacific St, Brooklyn 2, N. Y.**



Ac Magnetic Starter E43

These solenoid-operated starters are intended for across-the-line, nonreversing starting of polyphase and single-phase squirrel-cage induction motors. Starters can be controlled by separate pilot devices





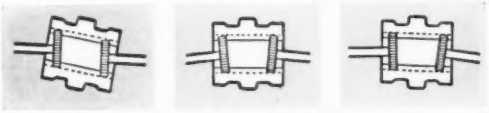
This

Metal-to-Metal Seal says "STOP" to Moisture, Dust and Grit!

That's why FAST'S COUPLINGS Give *Continuous* Service!

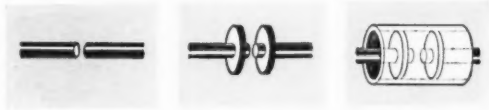
FAST'S self-aligning Couplings are completely free of perishable parts. They're all-steel throughout. At the vital spot shown above, this important feature is achieved through an *exclusive* "rocking bearing." This bearing is exclusive in providing a positive *metal-to-metal* seal that guards the load-carrying oil against troublesome moisture, dust and grit. The bearing is also exclusive in its correctly engineered position which allows *freedom of movement* to compensate for misalignment because its spherical base has the same axis as the hub spline faces. No perishable packing rings are used. There's nothing to wear, nothing to fail. Result: *uninterrupted* power transmission for all your installations!

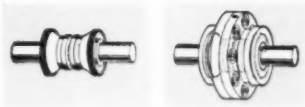
We have a complete line of couplings for immediate delivery. No matter which type of Fast's Couplings you buy, you get the benefits of years of top engineering experience, Koppers' high standard of workmanship and unexcelled coupling service which assures you of spare parts no matter how old your couplings may be. That means longer machine life, lower upkeep costs, minimum shutdown losses! Koppers Co., Inc., Fast's Coupling Dept., 241 Scott St., Baltimore 3, Md.



Compensate For All Misalignment

The floating sleeve takes a neutral position. All forms of misalignment are compensated for between the lubricated faces of the splines, equally divided between driving and driven members. The entire assembly revolves as one unit.





Simple As A-B-C

Fast's self-aligning Couplings are amazingly simple for the important job they handle. A splined hub on each shaft end. A sleeve with internal splines to mesh. Oil in the sleeve, kept between the splines by centrifugal force, carries the load between the splines.

KOPPERS

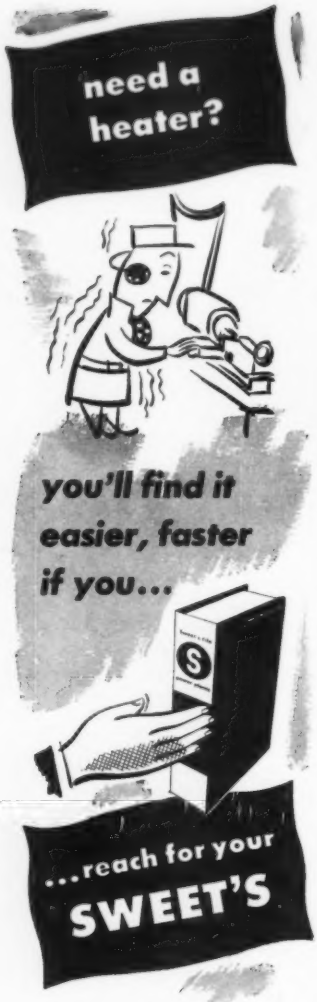
FAST'S *self-aligning* COUPLINGS

SEND FOR FREE CATALOG giving detailed descriptions, engineering drawings, dimension and capacity tables and typical installation photographs for the many types of Fast's Couplings. Fill out this coupon and mail it to: Koppers Co., Inc., Fast's Coupling Dept., 241 Scott St., Baltimore 3, Md.

Name ..... Position .....

Company .....

Street ..... City ..... State .....



When you need specific information on materials or equipment, reach for your Sweet's File for Power Plants (the big red file). It contains 118 manufacturers' catalogs full of useful information on thousands of products... from absorbers—gas, to zeolite. Cross indexing speeds finding.

If Sweet's File for Power Plants is not available in your office, make request immediately for application form. Files are distributed FREE to qualified organizations and individuals.

Sweet's

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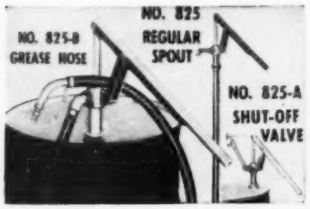
or through local control pushbuttons or selector switches.

Featuring high-arc-interruption capacity, compact unit construction and reliable thermal overload protection, these starters are supplied with built-in solderless connectors and double-break silver-to-silver main contacts. The Bulletin *4112*, Size 2, starters have a maximum enclosed rating of 25 hp, 440-550 v, 3 phases, 60 cycles. **Ward-Leonard Electric Co, Mt. Vernon, N. Y.**



Drum Pump E27

THIS PUMP handles heavy greases or light fluids at rates up to 3 gal per min. Spider design of piston and intake opening provides a cut-through action and large capacity. Smooth flow is maintained, as air pressure created by pump action eliminates splashing and waste. Pump fits 2- and 1½-in. barrel openings in 15-, 30- and 60-gal drums. **General Scientific Equipment Co, 2700 W Huntingdon St, Philadelphia 32, Pa.**

Building Wire E49

THE FINISHED SHEATH is flexible and much stronger than cotton or rayon, cannot burn and is unaffected by moisture or temperature changes. This insulation is immune to all ordinary acids and alkalies, and repellent to fungus and rodents. At present *Glazon* building wire is available in No. 12 and 14 sizes only. **Triangle Conduit Cable Co, New Brunswick, N. J.**

Floor Coating E50

CARBORUNDUM BASE, uniformly disposed throughout floor-covering paint, gives harder, long-wearing, moisture-resistant life. Paint may be applied by brush, spray or lamb's wool applicator. **Ender Paint Co, 46 Cornhill St, Boston 8, Mass.**

Roller-Chain Fastener E26

OF A RETAINING-RING TYPE this fastener has no dangerous points exposed. It has three internal, equally spaced teeth, sprung radially into a groove on the pin. Equal spacing of the teeth and spring action of the connecting links assure that the ring maintains a tight groove tension. When disassembly is necessary, recess between teeth makes the ring sufficiently resilient to permit removal without giving it a permanent set. Ring can be removed with an ordinary screw driver. **Atlas Chain & Mfg Co, Castor and Kensington Ave, Philadelphia 24, Pa.**

FOR FULLY AUTOMATIC CONTROL OF ALL WATER TREATMENT PROCESSES

EXPERIENCE COUNTS

• Panel designed for fully automatic control of Belco Softener, Alkalinity Remover and Deaerator in large process industry.

• Eleven alternate process cycles are precision controlled with this unit.

Belco engineers are thoroughly experienced in all phases of completely automatic water treatments. By applying this wide experience to your processes you can avoid the losses that result from outdated control — you can reap the savings that result from modern simplified automatic Belco control. Experience counts... Belco has, for example, the advantage gained through designing and building the worlds largest fully automatic demineralization and silica removal plant.

MODERNIZATION OF EXISTING PLANTS RESULTS IN LARGE OPERATING SAVINGS

Ask a Belco engineer how modernization might effect substantial savings in your present operations. Ask about the application of the Belco automatic controls to other processes in your plants.

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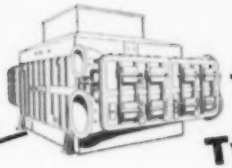
In midwest: Doody Chemical Co., Kansas City, Mo.
In southwest: Watermasters, Inc., Houston, Tex.
In Pacific: Doody Chemical Co., Los Angeles, Cal.

Belco

PROCESSES FOR REMOVAL OF WATER IMPURITIES



Two I-R Condensers for the new White River Generating Station

Indianapolis Power & Light Company

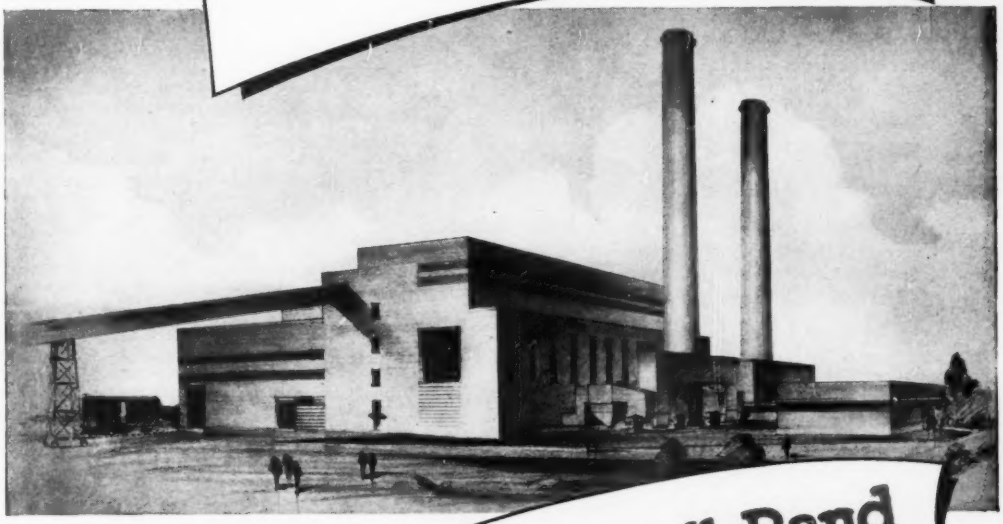
This big new power plant will add 160,000 kw generating capacity to the electric service system of the Indianapolis Power & Light Company. When finished, the station will house four 40,000 kw turbo-generators. Two units are being installed at present, and they will both be served by Ingersoll-Rand condensing plants.

Gibbs & Hill, Inc. of New York City are the consulting engineers for this plant, which incorporates the latest ideas in central station planning. One central control room will serve all four generating units and operation of the entire plant will be confined to the main operating floor. Make-up for the plant will be added in the condenser rather than the deaerating heater. This is accomplished by a large condensate storage tank and high and low level controls on the hotwell.

The selection of Ingersoll-Rand rectangular condensers and vertical condensate pumps resulted in unusually low basement height. Here again this combination is saving money and space in a new plant . . . foundations are smaller and building height is less.

Other I-R Equipment in the station

4 CIRCULATING WATER PUMPS
6 BOILER FEED PUMPS
1 SCREEN WASH PUMP
2 DRAIN TANK PUMPS
1 COOLING WATER BOOSTER PUMP
1 CHLORINATOR FEED PUMP
2 EVAPORATOR FEED PUMPS



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PUMPS · OIL & GAS ENGINES · REFRIGERATION
ROCK DRILLS · AIR TOOLS

Ingersoll-Rand

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APEXIORIZED

New boilers APEXIORized during the past year alone are serving these industries:

CHEMICALS	MACHINERY
FOODS	PUBLISHING
PETROLEUM	UTILITIES
BREWERIES	GOVERNMENT
TEXTILES	INSTITUTIONS
PAPER	MINING

Pick any industry where steam is generated for power or process and you've named a representative group of APEXIOR users — engineers who have proved the worth, in boilers large and small, of internal protective surfacing.

They know that even the strongest steel is powerless to resist moisture penetration — that water at its finest retains the capacity to impair — can never improve — bare steel. And so they separate the two, sealing boiler metal beneath a tissue-thin barrier of APEXIOR NUMBER 1.

Meeting steam and water is a surface that neither can dissolve — smooth, to deny a foothold to deposits — inert, so that it forms only a readily broken mechanical bond with any that adhere. The result, for the legion of APEXIOR users — —

- *maximum boiler availability — security against corrosion*
- *improved circulation, through friction-free tubes*
- *constant high heat-transfer efficiency*
- *easier, less frequent cleaning — lower maintenance cost*
- *speedier, positive inspection*
- *less outage time — longer on-the-line service*

Write us for more facts about:

DAMPNEY maintenance for metal

THE DAMPNEY COMPANY of AMERICA • Hyde Park, Boston 36, Mass.

Power News

(*Continued from page* 134)

The two steam-generating units required for initial installation are on order with Combustion Engrg Co. They will be designed to deliver 975,000 lb of steam per hr and 1550 psi, 950 F total temperature. Delivery of these units is scheduled for latter part of 1949 and early part of 1950.

The condensing equipment for first two units has been purchased from Foster Wheeler Corp, with 65,000 sq ft of condensing surface in each unit. Contract has been made with Blaw-Knox Co for all piping in the plant.

The steam generators will be designed for operation on pulverized coal, with natural gas as a supplementary fuel when available. Coal for the plant will be supplied from Kentucky and Tennessee mines.

A joint agreement between Frederic Flader, Inc, of North Tonawanda, N. Y., and Clark Bros Co, Olean, N. Y.—one of the 13 member companies of Dresser Industries, Inc, Cleveland, Ohio—has been entered into whereby Clark Bros Co will manufacture and distribute gas turbines and axial compressors of the Flader design for general industrial use. The agreement contemplates that Flader will be responsible for research, engineering and design, and that Clark Bros Co will manufacture and market these products.

The Flader axial-flow compressor, based on a new design principle, has recently been developed to a high degree of efficiency. Clark expects to develop a wide market for application in mining, petroleum and chemical fields, which the company now serves. The gas turbine in the Flader designs makes use of the axial-flow compressor and a high-efficiency combustion system using oil or gas. The industrial gas turbine is suitable for ships' propulsion, locomotive power and for driving air compressors, electric generators, pumps and other industrial machinery requiring development of large amounts of power.

Applications of heating, ventilating and air conditioning to industrial purposes are steadily increasing, as manufacturing requirements become more exacting, and many advances in specific equipment for such uses will be featured at the 9th International Heating and Ventilating Exposition. The exposition, which is sponsored by American Society of Heating and Ventilating Engineers, will be held at the International Amphitheater, in Chicago, Jan 24 to 28, in conjunction with the 55th annual meeting of the society.

Among novel uses of direct-fired space heaters, manufactured by one exhibitor at the forthcoming exposition, are the defrost-

How to *INCREASE BOILER RATINGS*

with your present furnace and stack

Coppus-Dennis FANMIX Burners Give You More Heat with No Other Major Change in Equipment

Coppus-Dennis FANMIX Burners give you *perfect* mechanical mixing of fuel and air *at the burner outlet . . . instantaneous* ignition close to the burner . . . and *complete* combustion *without visible flame* when burning natural gas. No other burner combines these three advantages.

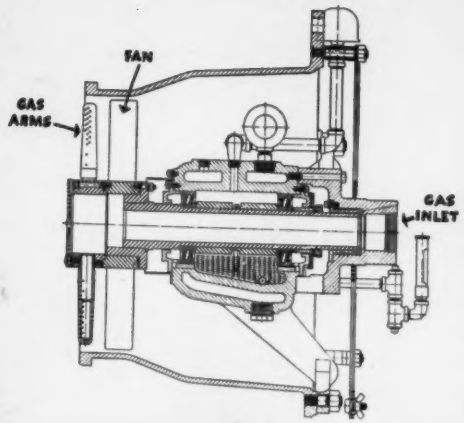
Because FANMIX delivers the *right* mixture of fuel and air *without blow-torch action*, all of your furnace space is used for combustion . . . *none for mixing*. That's why your present furnace can release more heat . . . why new installations can get more heat out of smaller furnace space.

Because FANMIX can be guaranteed to secure complete combustion of natural gas *with less than 5% excess air*, you get uniform "radiant heat" *without drifting hot spots*. That's why a FANMIX-fired furnace seldom varies in temperature more than 5% over its entire area.

WRITE FOR ALL THE FACTS

When you see in Bulletin 410–5 how fuel escaping from orifices in rotating driver arms rotates the fan to draw the correct proportion of air into the path of the fuel at right angles . . . how FANMIX creates its own forced draft, reduces stack requirements, prevents cracking of "wet" gas . . . how two FANMIX types handle either gas or oil or any combination of both — you'll understand why FANMIX Burners have such wide acceptance in oil refineries and power plants.

Send for the Coppus-Dennis FANMIX Bulletin 410–5. Coppus Engineering Corporation, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, and REFINERY CATALOG.



ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

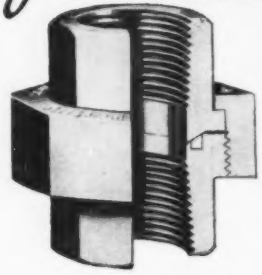
COPPUS ENGINEERING CORP.
161 Park Ave., Worcester 2, Mass.
Please send Bulletin 410–5 to:

Name .....

Company .....

Address .....

Jefferson UNIONS



Insure Against Leaks and Costly Shutdowns

All Jefferson Unions are designed around the **exclusively** "Jefferson" Recessed Brass Seat. This feature is not only a time, space and money saver on any job, but provides a seat which is practically one-piece with the iron and which leaves the runway clear and unobstructed. The seat cannot become dislodged regardless of how far pipe ends are screwed into the fitting. All "Jefferson" are of air-refined malleable iron, 55,000 to 65,000 lbs. per square inch tensile strength.

Full details on Jefferson Unions are available through your nearest distributor or from us direct.

JEFFERSON UNION CO.
605 W. 26th St., New York 1, N.Y.
83 Gooding St., Lockport, N.Y.
39 Fletcher Ave., Lexington 73, Mass.

Makes ALL VALVES *INSTANTLY* Accessible

CONTROL FROM THE FLOOR

● **Instant, handy, safe control of overhead and other out-of-reach valves. Eliminate danger to employees; banish the stepladder. Now — install valves anywhere they should be, regardless of accessibility.**

Inexpensive BABBITT Sprocket Rims fit all types and makes of valves, with either rising or non-rising stems. Installed quickly by clamping directly onto hand wheel of valve. Eliminates makeshift apparatus and specially-made chain wheels

• Ten standard sizes take care of all valve wheels from 3 to 80 inches in diameter.

• Request Catalog Bulletin P, prices, name of local distributor:

Babbitt Adjustable SPROCKET RIM with Chain Guards

BABBITT STEAM SPECIALTY COMPANY
Manufacturers of Adjustable Valve Operating Mechanisms
New Bedford, Mass. U.S.A.

ing of diesel locomotive trucks in winter, tempering makeup air in a second plant where paint spray and testing operations require a heavy exhaust of noxious fumes, and in a third plant, heat for curing tempered air for drying, warm air for comfort heating and ventilation of the whole plant in summer. Another exhibitor of equipment for recirculation and makeup air in industrial plants will display equipment delivering 73,000 to over 2,000,000 Btu per hr.

Westinghouse Electric Corp reports it will build a 65,000-kw turbine-generator for Texas Electric Service Co. The generator will be installed in the Fort Worth, Texas area and will be produced by Westinghouse plants in South Philadelphia and East Pittsburgh.

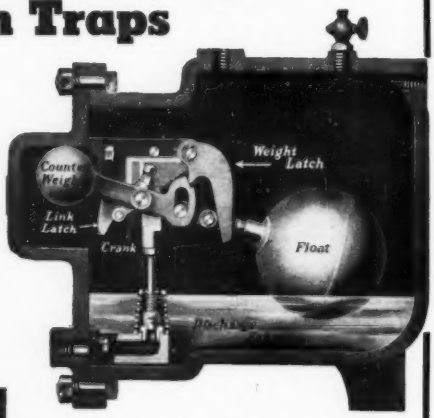
Dallas Power & Light Co has received City Council approval of its plans for a new $8,270,000 generating plant to be placed in operation in 1952. Utilities Supervisor J W Monk recommended approval. He told the Council the company's estimate of power showed the plant would be needed by that time. Plans call for construction of the 60,000-kw plant on the eastern edge of the city. The Council previously approved two 60,000-kw and two 12,500-kw generator additions to the company's system.

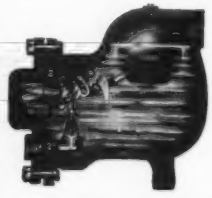
Six lithographed wall charts, in two colors, illustrating important areas of nuclear physics, have been prepared by Westinghouse Electric Corp's school service for class use in colleges and other schools. Magnificently rendered incolor on heavy sheets 25x36 in., the complete set of six charts sells for $1.

SPEED DRAINAGE with NICHOLSON

Non-Wire Drawing Steam Traps

As indicated at right, the valve of Nicholson weight - operated traps opens wide instantaneously to discharge condensate, after which it closes tight — instantaneously. 3 types for every application; pressures to 1500 lbs. CATALOG 448.





OTHER TROUBLE-PROOF FEATURES — Leakproofed by positive fluid seal over valve; not dependent on buoyancy or weight of float; unaffected by re-evaporation of condensate; rugged, for unavoidable abuse; unaffected by dirt, pulsation etc.; stainless steel where it counts.

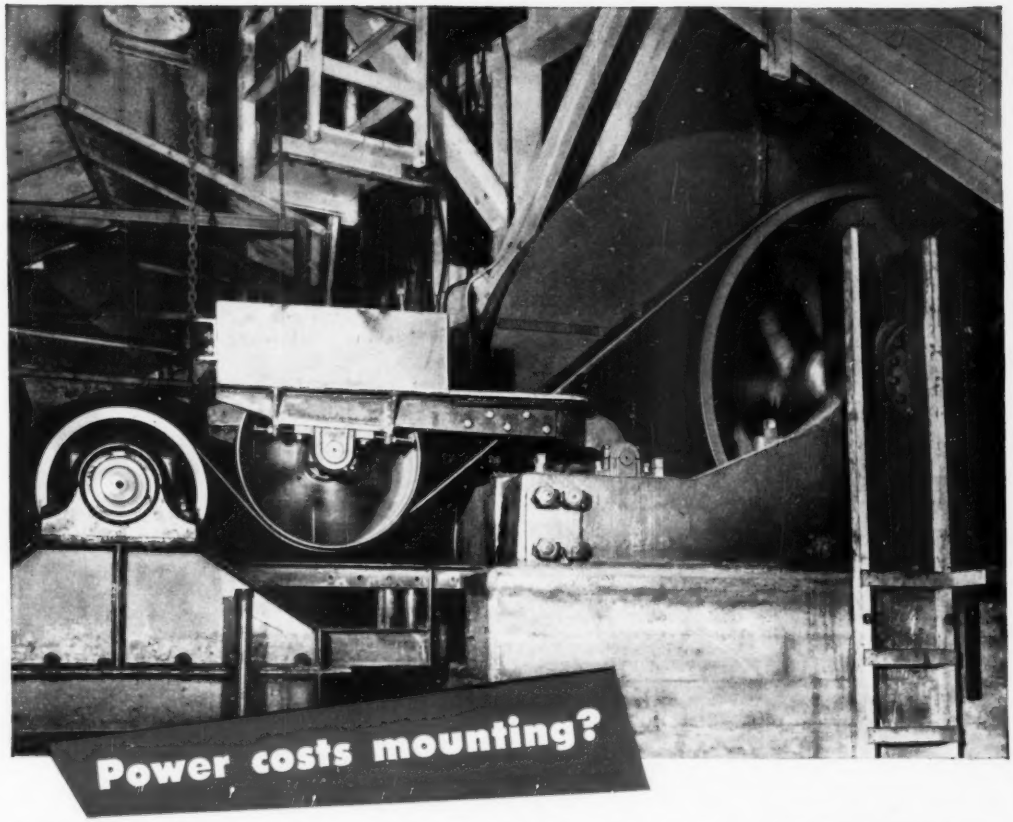
W. H. NICHOLSON & CO. 125 OREGON ST. WILKES-BARRE, PA.

POWER's History

POWER was founded in 1884 by E P Harris and H M Swetland. With it was incorporated *Steam*, which had been started by N Hawkins in Chicago two years earlier.

In 1903 POWER purchased and absorbed *Science and Industry*, which was a consolidation of a number of periodicals, namely, *Home Study Magazine*, *Home Study for Machinists*, *Mechanic's Magazine*, *Home Study for Building Trades*, *Building Trade's Magazine*, *Home Study for Electrical Workers* and *Steam Electric Magazine*.

In 1908 POWER absorbed *The Engineer's Review*, of Cleveland, and *The Engineer*, of Chicago, the latter being a consolidation of *The Safety Valve*, *Lord's Power and Machinery Magazine*, *The Stationary Engineer*, *Steam Engineering* and *The Mechanical Engineer*. When *The Engineer* was purchased, the name of the combined magazine was *Power and the Engineer*. The title was condensed to POWER in 1911. All rights to the preceding titles reserved.



Monarch Amber Transmission Belting reduces power loss and replacement costs

You'll often find the reason for high power costs in the transmission belting you use.

If you use ordinary belting, you know it stretches and slips plenty . . . wastes your power. And it just can't take severe abuse for long.

There's a simple way to reduce this expense. That is to use Monarch Amber Transmission Belting.

This remarkable belting *always* gives you maximum power delivery. That's because it's especially designed to prevent excess slippage.

Monarch Amber Transmission Belting licks your replacement problem, too. For its special ply construction can take even the severe flexing caused by small pulleys, high speeds, and short centers.

And, since it has no folds or seams, you can apply *either* side of this belting to the pulley. Result . . . it actually gives *double* traction life.

For full details on Monarch Amber Transmission Belting phone your Hewitt distributor. He's listed in the classified pages of your telephone book. Or write to the Hewitt Rubber Division, 240 Kensington Avenue, Buffalo 5, New York.

HEWITT
Transmission Belting

HEWITT RUBBER DIVISION
INDUSTRIAL HOSE • BELTING • PACKING

Why Hewitt Monarch Amber Transmission Belting Meets Your Needs

1 Made of highest quality gum rubber compounds and premium-grade, hard (silver) duck.

2 All plies straight-laid under uniform tension to insure even stresses throughout the belting.

3 Remarkably flexible and free from stretch because plies are completely insulated with pure gum rubber compounds.

4 No folds, no seams—due to straight-edge construction. Doubles traction life—makes possible use of either side.

HEWITT-ROBINS HR **INCORPORATED**

CHESTERTON "64" packing retains its compressibility even at high temperatures

You get more "take-ups" and fewer repacking jobs with "64", because diagonally laid asbestos cloth plys have greater resilience than "parallel to the rod" packings. For steam up to 400 p.s.i., superheated and hot gases, CHESTERTON "64" is made with a new binder which resists hardening and assures full gland take-up as wear takes place. We will be glad to send you a catalog on request describing the construction of "64" and 110 other styles of CHESTERTON's truly fine packings.

PACKS 25% More Rods per Pound of Packing

Because CHESTERTON "64" is *not* loaded with common rubber cement, it weighs 25% less per foot than ordinary packings. As you buy the pound, but use by the foot, "64" will save you many dollars yearly in its lighter weight alone. "64" will prove the most satisfactory packing you have ever used for high pressure steam rod service. Order CHESTERTON "64" today direct or from your local jobber and experience a brand new packing satisfaction.

"64" is one of 111 outstanding Chesterton Styles

A. W. CHESTERTON CO.
6 ASHLAND ST. EVERETT 49, MASS.

Chesterton

Established in 1884

Manuf's of famous CHESTERTON MECHANICAL PACKINGS and IMPORTERS of SONDERGLASS

APPOINTMENTS

Joy Mfg Co, Pittsburgh, Pa., announces appointment of J Y Richards as Chicago district sales manager.

A H Webber, district manager, representing **National Aluminate Corp,** Chicago, is opening an office in Independence Bldg, Philadelphia 6, Pa. Assisting him are J F Reardon and B J Lamb.

Wm Powell Co, Cincinnati, Ohio, names Joe L Comer vice-president in charge of sales in New York area. Comer's offices are at 50 Church St, New York City.

Aitkin-Kynett Co, Philadelphia, is retained by **Brown Instrument Co** to handle its publications advertising.

Edmund T Flanagan, manager of New York sales div, **Fairbanks Co,** becomes manager of regional sales in addition to his present position.

Monsanto Chemical Co appoints Edward J Bock manager of its plant at Monsanto, Tenn. Olin R Bailey succeeds Bock as maintenance superintendent. Thomas J Martin is branch sales manager at Detroit for Monsanto's plastics div, replacing Carl H Whitlock, who has resigned. Martin is succeeded by Jack W Porte as branch sales manager in St. Louis.

J T Gillespie Jr has been made sales manager for **Watson-Stillman Co,** Roselle, N. J.

Binks Mfg Co, Chicago, announces establishment of a customer service dept under the direction of Joseph Vokoun.

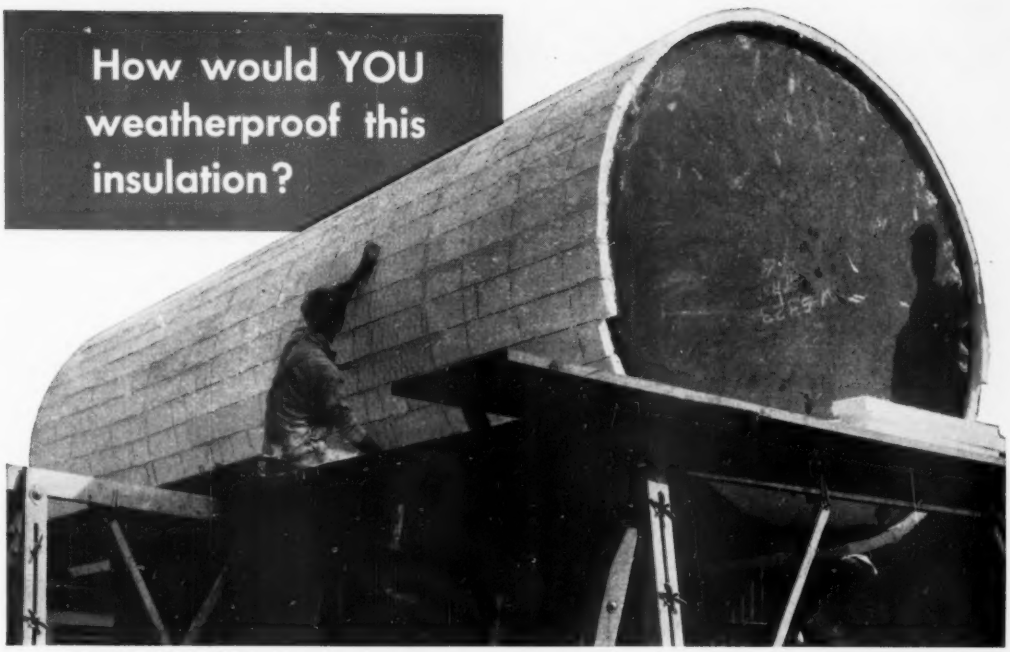
Election of Dr Harry K Ihrig to position of vice-president and director of laboratories is reported by **Globe Steel Tubes Co.** Also, Lee Mullen is promoted to vice-president in charge of sales.

Hewitt Rubber div, **Hewitt-Robins Inc,** Buffalo, names Industrial Supply Co, 1647 N Second St, Albuquerque, N. M., as its distributor in New Mexico area. Dan DaMant and Mark Crawford are president and vice-president of Industrial, respectively.

Cutler-Hammer's new branch sales office is located at 533 Mayo Bldg, Tulsa, Okla. B R Stratton manages the office as a branch of the company's Dallas district sales office.

Following appointments of sales engineers and representatives have been made by **E F Drew & Co,** New York City. L N Anderson—southern New England; Kenneth S Aitken—northern California and Washington; J S Beecher—Pittsburgh; Anthony F Brock—Cleveland; W H Burr—Chicago; Bruce E Cambridge—western Connecticut; P Q Card—Minnesota; M N Casper—Wisconsin; B J Desenberg—Michigan; J W Eder—Indiana; J V Francisco—Los Angeles; Flinco, Inc,—Rocky Mountain States; J C McCoy—Kansas City; Henry B Thomas—central Pennsylvania; F B Whalley—northern California and southern Oregon; Ralph F Blake—

How would YOU weatherproof this insulation?



This outdoor oil storage tank is being insulated with 2" of 85% Magnesia Block and two coats of asbestos cement. How would you protect the insulation on the tank from the weather?

- ☐ 1. Wrap the entire tank with roofing paper held in place with steel bands.
- ☐ 2. Trowel on two 1/8" thick coats of weatherproof plastic over wire mesh.

HERE'S WHAT THE ARMSTRONG ENGINEER RECOMMENDED:

The factors that the Armstrong engineer had to consider on this problem were: initial cost, economy of maintenance, and efficiency and appearance of the finish.

He found that the initial cost of applying the roofing paper was somewhat below that of trowelling on two coats of weatherproof plastic over wire mesh. However, there were other considerations that made the weatherproof plastic finish more economical and practical in the long run.

To maintain roofing paper properly, it should be painted with an asphaltic type paint every few years to keep it from cracking and breaking. A plastic finishing material, such as Armstrong's Insulmastic, will not crack in cold or soften in heat.

Furthermore, it is almost impossible to get a tight, neat roofing paper job on a horizontal tank this large, even if all joints are sealed with an asphaltic sealer. In a short time, the paper is liable to become bumpy and uneven and also to become loose at the joints, allowing water to get in and lessen the efficiency of the insulation. Insulmastic trowels on smoothly and evenly, sealing tightly and keeping its trim appearance over the years.

With these considerations in mind, the Armstrong engineer recommended two coats of Insulmastic. In addition to the advice of highly trained engineers, you can call upon Armstrong's Complete Contract Service for skilled workmanship and highest quality materials. The Contract Service is equipped to handle any insulation job involving temperatures from 300° below zero to 2800° F.

FREE INSULATION CHART

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write to Armstrong Cork Company, Industrial Insulation Department, 7001 Maple Ave., Lancaster, Penna.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

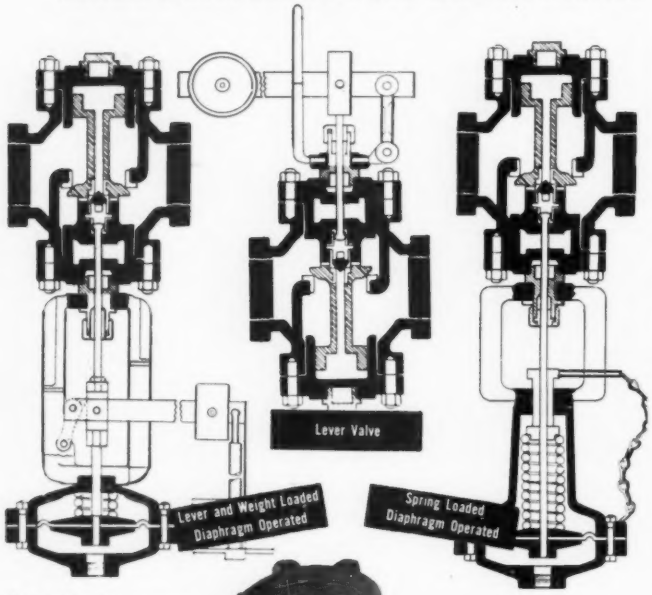
From 300° Below Zero

To 2800° Fahrenheit

Dependable SERVICE

...POSITIVE, ACCURATE REGULATION

STICKLE VALVES DESIGNED FOR WIDE APPLICATION



● Stickle Series 400 Valves, available in three designs, each in small to large sizes, are applicable to a wide range of industrial operating conditions. Handle high velocities resulting from heavy pressure reductions. Maintain constant reduced pressure against variable supply pressure. Accommodate full pipe capacities.

● Stickle Series 400 are single seated, balanced valves. Easy opening and closing. No chatter. Leak proof. Valves and valve seats are RENEWABLE. Main valve and pilot valve and seat may be reground independently. Repairs made at point of use and without removing valve bodies from lines.

BULLETIN No. 435 supplies information and engineering data. Also ask for Bulletin No. 435 if you are interested in Double Seated, Semi-Balanced Valves.

STICKLE STEAM SPECIALTIES COMPANY
2265 Valley Avenue, INDIANAPOLIS 18, INDIANA

Successfully Serving for More than 40 Years Paper Mills, Food Processors, Textile and Hosiery Mills, Laundries and Other Manufacturers Using Steam for Industrial Processing

STICKLE EQUIPMENT

STICKLE DIFFERENTIAL AND BOILER RETURN SYSTEMS • STICKLE OPEN FLOAT STEAM TRAPS • STICKLE REGULATING AND REDUCING VALVES • STICKLE OPEN COIL FEED WATER HEATERS AND PURIFIERS • STICKLE OIL AND STEAM SEPARATORS STICKLE TEMPERATURE CONTROLLERS AND OTHER SPECIALTIES

Maine and New Hampshire: John R Hansen—Albany and Schenectady; J P Zaro—Boston and western Massachusetts.

Edward X Hallenberg, as assistant director of **Westinghouse** research labs, serves as administrative aide to Dr Hutcheson. In addition, he assumes responsibility for all laboratory service activities.

Buda Co, Harvey, Ill., acquires W F Hebard & Co, 336 W 37th St, Chicago, Ill., manufacturers of materials-handling equipment.

Charles L Haslup has been appointed sales manager of field operations for **Reading-Pratt & Cady div,** American Chain & Cable Co. Haslup maintains headquarters in Reading, Pa.

Marcus Transformer Co, Hillside, N. J., selects W E Holiman Co, P O Box 851, Houston, Texas, as its territorial representative for Texas, Louisiana, and Oklahoma.

James R Longwell and F C Ritner are assistant to the president, and vice-president in charge of engineering, respectively, for **Carboloy Co.**

Elgin Softener Corp, Elgin, Ill., announces retirement of Lucius A Fritze. E W Scarritt takes over the duties of Fritze as vice-president and director of sales. Fritze continues to serve as a member of the corporation's board of directors.

George H Sahler has been appointed manager of marketing research of **Trumbull Electric Mfg Co,** Plainville, Conn. Also, William A Edwards has been named manager of switch, breaker, control sales, and Yale T Chaney, manager of distribution systems sales.

Plibrico Jointless Firebrick Co, Chicago, has made Howard W Thompson manager of Plibrico Sales & Service Co. Thompson maintains offices at Fort Worth and at Santa Fe Bldg, Unit 2, Dallas.

Additional distributors for **Ampco Metal, Inc,** are as follows: Allied Weld-Craft, Inc, 401 West South St, Indianapolis, Ind.; Arizona Welding Equip Co, 815 E Broadway, Tucson, Ariz.; Welder Service Co, 2037 Canton St, Toledo, Ohio.

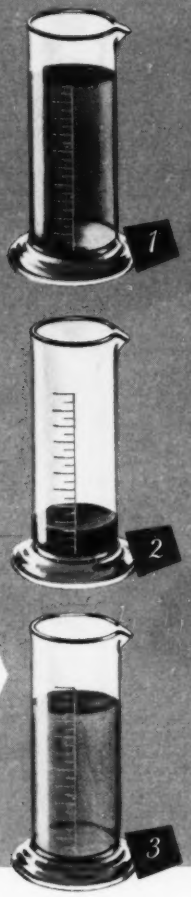
Bowser Inc, Fort Wayne, Ind., names Fred S Ehrman vice-president and director of sales.

As manufacturer's representative, Frank D Messenger promotes Penn Drake products throughout lower Michigan peninsula for **Pennsylvania Refining Co,** Cleveland, Ohio. Messenger's sales headquarters are at Fair Haven, Mich.

General Electric Co announces several personnel changes in its divisions: In wiring device div, J Rosser Murray becomes manager of manufacturing with John J Ryan as assistant. Charles A Lindemann is named manufacturing engineer. Edward G Hopkins becomes materials manager of above div at Bridgeport, Conn. Hopkins is succeeded by Russell L

Extra Refining
means *Superior Performance*

GULFCREST
is the only turbine oil refined by the
Alchlor Process



Gulfcrest is the only turbine oil that is Alchlor-processed. This is an extra refining step. It makes Gulfcrest extra pure and extra efficient.

In Cylinder 1 you see the oil that will become Gulfcrest. It has already gone through the usual steps used in refining most other turbine oils—but has not yet been Alchlor-processed.

In Cylinder 2 you see the part—approximately 15%—discarded by the Alchlor Process. This is the part that, when allowed to remain in turbine oil, is most likely to oxidize, increase neutralization number, and form sludge, emulsifiers, and harmful acids.

In Cylinder 3 you see the finished Gulfcrest — the incomparably pure lubricating oil that gives outstanding performance and helps you keep steam turbine systems clean indefinitely. To make it even finer, special inhibitors are added to it—they give it still greater stability and protection against corrosion.

Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines. Write, wire, or phone your nearest Gulf office.

Gulf Oil Corporation · Gulf Refining Company

Division Sales Offices:

Boston · New York · Philadelphia · Pittsburgh · Atlanta
New Orleans · Houston · Louisville · Toledo

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation · Gulf Refining Company P
3800 Gulf Building, Pittsburgh 30, Pa.

Please send me, without obligation, a copy of your booklet "Gulfcrest Oil for Steam Turbine Lubrication."

Name .....

Company .....

Title .....

Address .....

INCREASING YOUR HOLD ON YOUR JOB

and giving yourself a chance for advancement

Few men deliberately plan to work persistently on self-improvement. If progress comes naturally, they are happy; if it does not, they either worry or they entirely ignore the situation.

Yet it is possible to pay attention to self-improvement with considerable hope of success. A noticeable degree of advancement is practically *assured* to anyone who will make an intelligent and persistent effort.

Thousands of men have proved this for themselves, with the use of

The CROFT Library of Practical Electricity

7 Volumes, 2906 pages
1948 how-to-do-it illustrations

● The Croft Library is a complete electrical educator. Founded on practice—on 20 years of shirt-sleeve experience—on work as it is actually done. Jammed from cover to cover with the kind of hardheaded facts you want. Written so that the beginner can easily understand it, yet so sound, so thorough, that it is the daily guide of 59,000 highly paid electrical workers and engineers.

● Croft tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, switchboards, distribution systems—electrical machinery of every type—illumination in its every phase—the most improved methods of lighting—lamps and lamp effects, etc.—how to do a complete job, from planning it, to completion.

NO MONEY DOWN
EASY PAYMENTS
10 DAYS' FREE EXAMINATION

Fill in and mail the coupon below and we will send you the entire set of seven volumes for ten days examination on approval. We will take all the risk—you assume no obligation. If you decide to keep the books, send $3.50 in ten days and the balance at the rate of $4.00 a month.

Send this* McGRAW-HILL *coupon

McGRAW-HILL BOOK CO.
330 W. 42nd St., New York 18, N. Y.

You may send me the seven volumes of the Croft Library of Practical Electricity for 10 days' examination. I agree to return the books, postpaid, in ten days or remit $3.50 then and $4.00 a month until the special price of $19.50 has been paid.*

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Home Address .....

City and State .....

Position .....

Company P-1-49

*SAVE: We pay mailing costs if you send first payment with this coupon. Same return privilege.

Priestly as factory manager at Norfolk, Conn. Harry Hill is promoted to production superintendent of integrated manufacturing operations and James B Corrigan becomes production superintendent of non-integrated manufacturing operations. In the apparatus dept W V O'Brien is general sales manager.

Also, **GE's** construction materials dept is making some changes: F Penn Holter becomes assistant manager of manufacturing and Clarence C Walker general manager of the department. Charles R Shields is manager of marketing. Materials coordinator is Charles K Skinner. Frederick V Courtade becomes manufacturing engineer of conduit products div. In the reorganization of chemical dept into two divisions instead of four, Harry K Collins and John L McMurphy are named to managerial posts of plastics div and chemicals div, respectively. Assisting Collins are Frank W Warner, Robert O Bullard, Donald S McKenzie, Elmer H Gabel and Arthur C Treece. Members of McMurphy's staff are C Stewart Ferguson, John A Zellhoefer, Robert A Rieker and Erwin T Kilgore.

In **GE's** other divisions the following announcements have been made: Dr James R Donnalley has become manager of silicone manufacturing plant at Waterford, N. Y. Herbert M Brusman has joined the chemical dept as manager of employe relations div. In the same dept Dr Charles E Reed has become engineering manager and Robert L Gibson has been appointed assistant general manager.

Titeflex, Inc, Newark, N. J., selects Manufacturers Sales Agency, 523 Brushton Ave, Pittsburgh 21, Pa., as its exclusive sales agents in western Pennsylvania and West Virginia. Lewis Detch is manager. Associated with him are N Chirumbole, Herbert Jones and Roy Evissel.

Energy Control Co, 5 Beekman St, New York 7, N. Y., with district offices in Newark, N. J., New Haven, Conn., and Albany, N. Y., has been chosen as general representative for **J E Longergan Co,** Philadelphia, Pa. Territory covered includes New York Metropolitan area, northern New Jersey, southern Connecticut and the Hudson Valley, all the way to Canadian border.

Bird-Archer Co announces opening of an office in M & M Bldg, Houston, Texas. Engineering personnel operating from this office are Gene W Clark, C K Hoffmeister and L W Stitt.

Livingstone Engrg Co, Worcester, Mass., will have its line of *Speedylectric* steam boilers handled in northern California by Merrill-Brose Co. Located in San Francisco, Merrill-Brose is a new subsidiary of **Merrill Co,** who previously handled Livingstone's products. George Brose, vice-president, will be general manager.

E P Tait is now southeast district sales engineer for **Alloy Steel Products Co,** Linden, N. J. Tait will be engaged in field engineering, sales and service work in

(*Continued on page* 184)

"GUNITE" Concrete

(since 1915)

Linings for

STEEL BUNKERS •
DUCTS, HOPPERS •
STACKS •
UPTAKES •
BREECHINGS •
STEEL & PIPE •
ENCASEMENT •
FIREPROOFING •

GUNITE CONCRETE & CONST. CO.

1301 Woodswether Road
KANSAS CITY 6, MO.

R. N. Turner, Dist. Mgr., 228 Nor. La Salle St., Chicago 1, Ill. B. H. Mueller, Distr. Mgr., 6625 Delmar Blvd., University City. (St. Louis), Mo. Philip D. Barnard, Distr. Mgr., 2836 Addison, Houston 5, Tex.

Branch Offices: New Orleans, Dallas, Denver.

EISLER TRANSFORMERS

STANDARD & SPECIAL
From ¼ to 400 KVA up to 15,000 volts
We manufacture a complete line of:
***AIR, OIL OR WATER-COOLED DISTRIBUTION TRANSFORMERS**
***Special Designs available to meet Customers' Specific Requirements**

TRANSFORMERS FOR
***ELECTRIC FURNACES**
***WELDING**
***HEATING**
***PHASE CHANGING**
Etc.

POWER & LIGHT TRANSFORMERS
For isolation of Light from Power, or Light from Telephone

EISLER TRANSFORMERS are *manufactured strictly to Standards of the N.E.M.A., A.S.A., and A.I.E.E.*

WRITE FOR SPECIAL CATALOG

EISLER ENGINEERING CO., INC.

Chas. Eisler, Pres.
757 South 13th Street, Newark 3, N. J.

Reader Service Page for . . .

NEW EQUIPMENT and TECHNICAL LITERATURE

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

NEW PRODUCTS & MATERIALS

See pages 122-126, 132, 160-170

Diesel Torque Converter.....page 122
Pulverizer.....page 122
Dial Thermometer.....page 122
Silver Alloy.....page 122
Nickel-Cadmium Battery.....page 122
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Insulating Tape.....page 124
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MANUFACTURERS' BULLETINS

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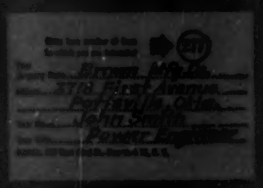
HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the second line and drop the cards in the mail.



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BOILERS AND AUXILIARIES

1 AUTOMATIC STEAM GENERATORS —Cyclotherm Corp, 90 Broad St, New York 4, N. Y. 4-page bulletin No. P-1 describes construction and operation of Cyclotherm automatic steam generators. Standard ratings and dimensions are included.

2 FIREBOXES FOR OIL BURNERS—Refractories Div, Babcock & Wilcox Co, 85 Liberty St, New York, N. Y. Bulletin No. R-36B discusses design and construction of modern fireboxes for domestic and small commercial oil burners.

3 PUMP AND HEATER SETS—Peabody Engrg Corp, 508 Fifth Ave, New York 18, N. Y. 4-page bulletin shows various elements and factors that must be considered in ordering a pump and heater set.

ELECTRICAL EQUIPMENT

4 INDOOR TRANSFORMERS — Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 4-page bulletin No. 61B3604A describes transformers that are filled with Chlorextol, a fireproof insulating liquid, for safe indoor installations.

5 ROUND POWER RHEOSTATS—Rex Rheostat Co, P O Box 288, Baldwin, L. I., N. Y. 4-page catalog No. 4 covers vitreous enameled round power rheostats in seven sizes, from 50 to 500 watt.

6 DRY-TYPE TRANSFORMERS—Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 16-page booklet No. 61X7543 discusses installations, care and operation of dry-type transformers.

7 VARIOUS TRANSFORMERS — Ehrler Engineering Co, 766 South 13th St, Newark 3, N. J. 24-page catalog No. TB-49 covers Ehrler transformer line, including distribution, lighting, heating, welding, electric furnace, etc.

8 LOAD-CENTER UNIT SUBSTATIONS —Allis-Chalmers Mfg Co, Milwaukee 1, Wis. 16-page bulletin No. 11B8386A, entitled "How Power at Load Centers Pays Off" includes a simple and flexible system that makes it easy to select correct air circuit breaker for any application of a standardized load center unit substation.

MAINTENANCE MATERIALS

9 FLOOR TREATMENT—Sinnhard Co, 1346 Spring Garden St, Philadelphia 23, Pa. 4-page folder tells how Sinnhard Sinstop eliminates dust, hardens and protects surface of concrete floors.

10 CORROSION INHIBITIVE PRIMERS—Lead Industries Assn, 420 Lexington Ave, New York 17, N. Y. 4-page technical letter No. 2 gives latest recommendations for formulation of corrosion inhibitive primers for protection of atmospherically exposed iron and steel.

11 FLOOR PATCH, PACKING — Flexrock Co, Filbert and Cuthbert, West of 34th, Philadelphia 4, Pa. 4-page folder discusses Rockfluz, a heavy-duty concrete floor patch. 4-page leaflet gives advantages of Flexrock MPP for machine shop floor patches. 4-page booklet describes Flexrock plumbers' special self-forming packing.

12 ENERGY FLOORING — Walter Maguire Co, 116 W 42nd St, New York 18, N. Y. 4-page bulletin No. 602 tells about the experience of a large railroad system with heavy-duty epoxy flooring on freight platforms.

MATERIALS HANDLING

13 ELEVATORS AND ESCALATORS—Otis Elevator Co, 260 11th Ave, New York 1, N. Y. 12-page booklet No. B-3615 (8470) presents Otis duplex collective control that coordinates operating of two full collective control elevators. 16-page bulletin No. B417 (8490) discusses Otis passenger elevators, Escalators, freight elevators and dumbwaiters. 4-page folder No. B600 (8430) gives advantages of the Otis flexible guide clamp safety. Publication No. B585 (8470) covers features of Micro 3-way leveling for elevators.

14 WIRE ROPE — Wickwire Spencer Steel Div, Colorado Fuel and Iron Corp, 500 Fifth Ave, New York 18, N. Y. The 50th anniversary catalog has three indexes that permit quick reference to the contents. First section covers characteristics of wire rope. Second section describes wire rope for specific industries. Third section deals with care and handling of wire rope.

METERS AND INSTRUMENTS, MECHANICAL

15 GAGES, METERS AND CONTROLLERS—Brown Instrument Co, Wayne and Roberts Ave, Philadelphia 44, Pa. 12-page catalog 9-5000 gives complete description of various instruments, such as indicating and recording pressure gages, recording flowmeters and pressure gages, air-operated controllers, non-indicating pressure controllers, indicating furnace pressure controllers, precision pressure regulators, etc. 16-page catalog No. 14-12 discusses pH and conductivity control.

16 SMOKE METER — Radnorf Supply Co, 421 E 4th St, Tulsa 3, Okla. 4-page folder describes the E-3 smoke meter for determination of smoke density in stack gas.

17 SPEED MEASURING INSTRUMENTS — James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa. 24-page bulletin No. 35-14 presents description, operation and selection of chronometric, centrifugal and resonant reed tachometers. It includes a variety of integrating and direct-indicating instruments together with such variations as the tachometron, tachoscope, tachograph and many adaptations of the Frahm resonant reed principle.

18 PNEUMATIC TRANSMITTERS — Republic Flow Meters Co, 2240 Diversey Parkway, Chicago 47, Ill. 32-page data book No. 1061 contains up-to-date information on Republic pneumatic transmitters and their application to measurement of flow, level, pressure and density.

19 RECORDERS AND CONTROLLERS —Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa. 32-page catalog No. ND44(1) lists complete line of strip-chart Micromax recorders and controllers for measuring temperature, speed, gas analysis, electrolytic conductivity, pH, etc.

PIPING, FITTINGS, VALVES AND SPECIALTIES

20 SAFETY AND RELIEF VALVES—Farris Engrg Corp, 484 Commercial Ave, Palisades Park, N. J. 72-page catalog No. 48 gives data on installation and use of safety and relief valves.

21 LUBRICATED PLUG VALVES—H K Porter Co, Inc, 47 46th St, Chicago 39, Ill. 16-page catalog covers complete line of Porter lubricated plug valves.

(Continued on page 188)

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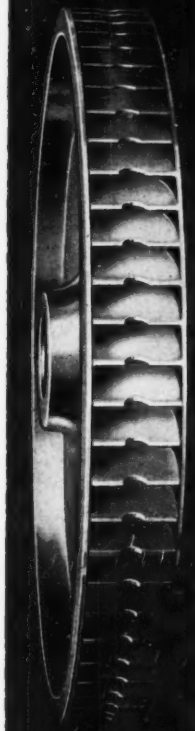
TERRY



QUICK-STARTING
TURBINE
FOR FEED PUMP
EMERGENCY DRIVE

The turbine shown at the right picks up the feed-pump load in case the motor, which normally drives the unit, is inoperative. Thus the turbine must be able to start quickly and be completely reliable —characteristics which are assured by the generous blade clearances and one-piece construction of the Terry Wheel.

This is but one example of many special turbine requirements that are met by the Terry solid-wheel turbine. Details on how this and other Terry Turbines will meet your individual needs will be gladly supplied by a Terry engineer.

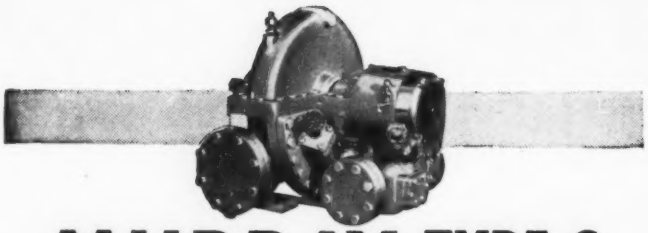
DATA

The turbine is 620 hp, 3550 rpm for 850 psi, 900F steam with 2.5 psi back pressure.

Installed in the Crawford station, Middletown, Pa., Metropolitan Edison Co. Gilbert Associates, Inc. were the consulting engineers.

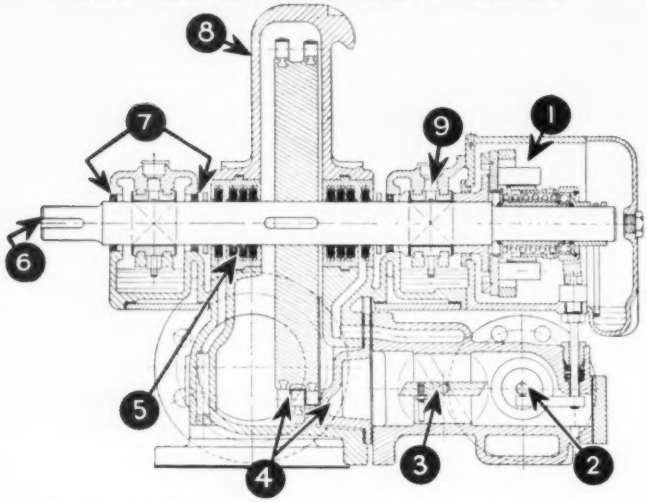
T-1178

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.



MURRAY *TYPE-S*

SINGLE STAGE TURBINES FOR MECHANICAL DRIVE



1. Mechanical constant speed governor completely enclosed and fully lubricated. Heavy cast housing, removable for inspection. Provision for tachometer reading, by removing end plug.
2. Double seated balanced stainless steel governor valve, with stainless steel renewable seats. Corrosion resisting steam strainer ahead of control valves.
3. Separate emergency overspeed butterfly trip valve actuated by unbalanced weight type emergency overspeed governor.
4. Stainless steel blading and shroud band. Nozzles drilled and reamed in replaceable nozzle ring.
5. Carbon ring glands, stainless steel springs, corrosion resisting gland cases. Cast in leakoff reduces pipe fittings necessary.
6. Tapped hole in shaft end facilitates drawing on coupling.
7. Bearing seals effectively retain oil and exclude dirt and moisture.
8. Casing split at centerline allowing inspection without disturbing alignment or steam connections.
9. Sleeve type babbitt lined bearings with split oil rings, easily removable. Babbitt thrust faces against collars. Inspection covers and flush level glasses included. Water cooling always furnished.

FOR DEPENDABILITY, SPECIFY A MURRAY TURBINE

Bulletin T-121 gives complete details. Write for your copy today.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

22 STEEL VALVES — Edward Valves, Inc, East Chicago, Ind. 4-page bulletin No. 709 presents new group of Edward steel valve designs. Included are pressure-seal bonnet stop, check or non-return valves, welded bonnet Univalves, blowoff valves, gate valves and gage valves.

23 SEPARATORS AND EXHAUST HEADS—Wright-Austin Co, 315 W Woodbridge St, Detroit 26, Mich. 28-page catalog No. 500 describes steam, oil, air and gas separators. This catalog also includes exhaust heads.

24 LUBRICATED PLUG VALVE—Homestead Valve Mfg Co, Coraopolis, Pa. Section 5 of valve reference book No. 39 covers Homestead-Reiser Self-Seald lubricated plug valve. It offers general catalog data, descriptions, specifications and prices on the units, parts and accessories.

25 RUBBER EXPANSION JOINTS—Garlock Packing Co, Palmyra, N. Y. 8-page folder discusses Garlock rubber expansion joints for pressure, vacuum or pressure and vacuum.

WATER TREATMENT

26 STEAM LINE CORROSION CONTROL—Power Chemicals Div, E F Drew & Co, 15 E 26th St, New York 10, N. Y. 4-page technical bulletin describes action and application of Drew treatment for prevention of corrosion in steam lines, condensate lines and plant equipment.

27 CORROSION IN BOILER SYSTEMS—W H & L D Betz, Gillingham and Worth St, Philadelphia 24, Pa. 12-page technical paper No. 111, entitled "Corrosion: Its Effect in Boiler Systems," discusses cause and prevention of corrosion in boiler systems.

WELDING

28 GAS-WELDING AND FLAME-CUTTING APPARATUS—Victor Equipment Co, 844 Folsom St, San Francisco, Calif. 40-page catalog, Form No. 20B, shows a comprehensive portion of line of Victor gas-welding and flame-cutting apparatus.

29 INERT GAS WELDING — Fansteel Metallurgical Corp, North Chicago, Ill. 4-page bulletin No. 1.102 shows, from actual photos, the uniform clean welds, without grinding or polishing, made by inert welding with Fansteel electrodes.

OTHER EQUIPMENT

30 STEAM JET EXHAUSTERS AND COMPRESSORS—Schutte and Koerting Cb, 12th and Thompson St, Philadelphia 22, Pa. 16-page bulletin No. 4-E describes complete line of SK steam jet exhausters and compressors for use with pump priming, exhausting, evacuating, cleaning, transporting and agitating liquids and gases.

31 RELAY DESIGNS—Advance Electric and Relay Co, 1260 West Second St, Los Angeles 26, Calif. 48-page catalog covers entire line of standard Advance relays, complete with descriptive detail, dimensions, contact combinations and prices.

32 BOILER WATER-LEVEL CONTROL—Northern Equipment Co, Erie, Pa. 8-page bulletin No. 487 discusses boiler water level control at Blackhawk Generating Station of Wisconsin Power & Light Co.

33 HEAT EXCHANGERS—Ross Heater & Mfg Co, 1407 West Ave, Buffalo 13, N. Y. 8-page bulletin No. 1.1K1 gives informative data on the new Ross BCF exchangers. Cut-away views illustrate construction and line drawings show sizes, dimensions and weights.

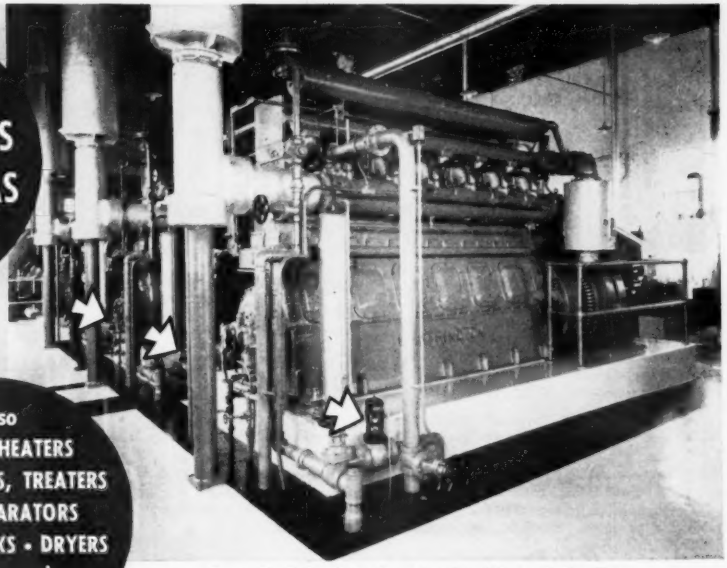
34 PORTABLE AIR TOOLS — Buckeye Tools Corp, Dayton 1, Ohio. 44-page catalog features completely redesigned line of Stream-Power portable air tools.

35 ROLLER CHAIN — Atlas Chain & Mfg Co, Castor and Kensington Ave, Philadelphia 24, Pa. 8-page catalog, entitled "Atlas Roller Chain," lists prices and specifications for single and multiple chains ranging in size from No. 25 to No. 200.

For Better TEMPERATURE CONTROL

Of cooling water for
COMPRESSORS DIESEL and GAS ENGINES

Prevent OVER- and UNDER-Cooling • Increase Operating Efficiency • Economize on Use of water.



Powers No. 11 Regulators Controlling Diesel Engine Cooling Water

Also
WATER HEATERS
OIL HEATERS, TREATERS and SEPARATORS
VATS • TANKS • DRYERS
and many other uses

Prevent OVER-heating, Save Fuel, Improve Production

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Self-Operating
Easy To Install
Save Labor

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Valve Sizes ¼" to 2" have double unions
Sizes 2½" to 6" incl. have flanged ends

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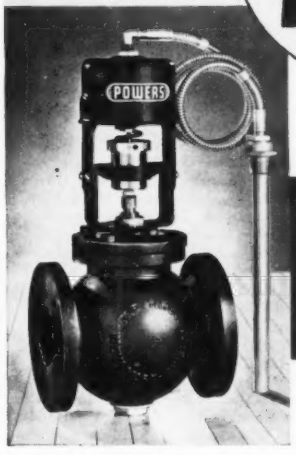

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SIMPLIFY your temperature control problems by standardizing on POWERS regulators. Use them wherever you want to maintain a constant temperature with year after year dependability of operation. Often give 10 to 25 years of service and pay back their cost several times a year. Call in a Powers engineer for an estimate or write for Bulletin 329CD. (11DC)

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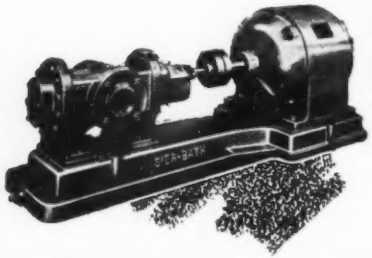
Can a pump be TOO GOOD?

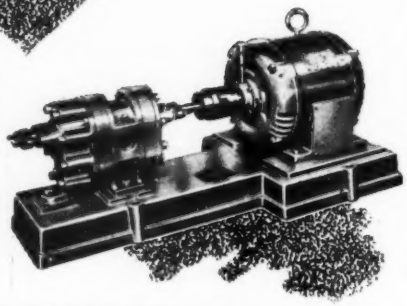
WE believe that no pump used in industrial processes can be too good. The cost of only one shut-down for pump replacement or repair often exceeds the difference in price between the best pump it is possible to obtain—and the second-best.

That is why we put *everything* that engineering ingenuity can devise into Sier-Bath Screw Pumps and Gearex Pumps. As a result, Sier-Bath Pumps are noted for their dependability and durability and for requiring the absolute minimum in down-time for maintenance.

Sier-Bath Screw Pumps and Gearex Pumps are made in a modern plant under the best working conditions, by a company that has long been noted for the manufacture of precision gears. In the making of our pumps we adhere to the rigid standards of high quality that have made Sier-Bath Precision Gears famous among manufacturers of quality products. Send for booklet on Sier-Bath Screw Pumps or Sier-Bath Gearex Pumps.



SIER-BATH Screw Pump Advantages: Pulseless flow, anti-friction bearings, vibrationless operation, low maintenance costs, rugged construction. Pumps acetate, asphalt, brines, bunker C fuel oil, cellulosics, greases, molasses, syrups, lube oil, etc.



SIER-BATH Gearex Pump Advantages: balanced axial thrust, vibrationless operation, roller bushings for precision running under load. Pumps oils, varnishes, solvents, molasses, chemical solutions. Capacities 1-550 g.p.m. Discharge 250 p.s.i. for medium or high viscosities, 50 p.s.i. for water.

ALSO MAKERS OF SIER-BATH PRECISION GEARS

FOUNDED 1905 MEMBER A. G. M. A.

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36 GRAPHIC WATTMETER—Esterline-Angus Co, Box 596, Indianapolis 6, Ind. 16-page booklet, entitled "Solving Industrial Crimes, Case No. 36," tells how a sugar refinery eliminated frequent wrecks in apparatus by installing an Esterline-Angus graphic wattmeter, which found out the cause of the trouble.

37 DIESEL ENGINES—Nordberg Mfg Co, Milwaukee 7, Wis. 12-page bulletin No. 161 gives design and operating features of Nordberg 4-cycle diesel engines in 9- and 13-in. cylinder sizes providing a power range from 150 to 1370 hp.

38 CENTRIFUGAL PUMPS—Economy Pumps, Inc, Hamilton, Ohio. 20-page catalog No. A1147 describes construction of Economy single-stage, horizontally split case centrifugal pumps.

39 AUDIBLE - VISUAL ANNUNCIATORS—Autocall Co, Tucker Ave, Shelby, Ohio. 4-page folder presents Type ANG audible-visual annunciators for industrial and public utility signalling purposes.

Appointments

(*Continued from page* 180)

territory including Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama and Mississippi. His headquarters are at 333 Candler Bldg, Atlanta, Ga. Also, H E Johnson is named sales manager with offices at Linden.

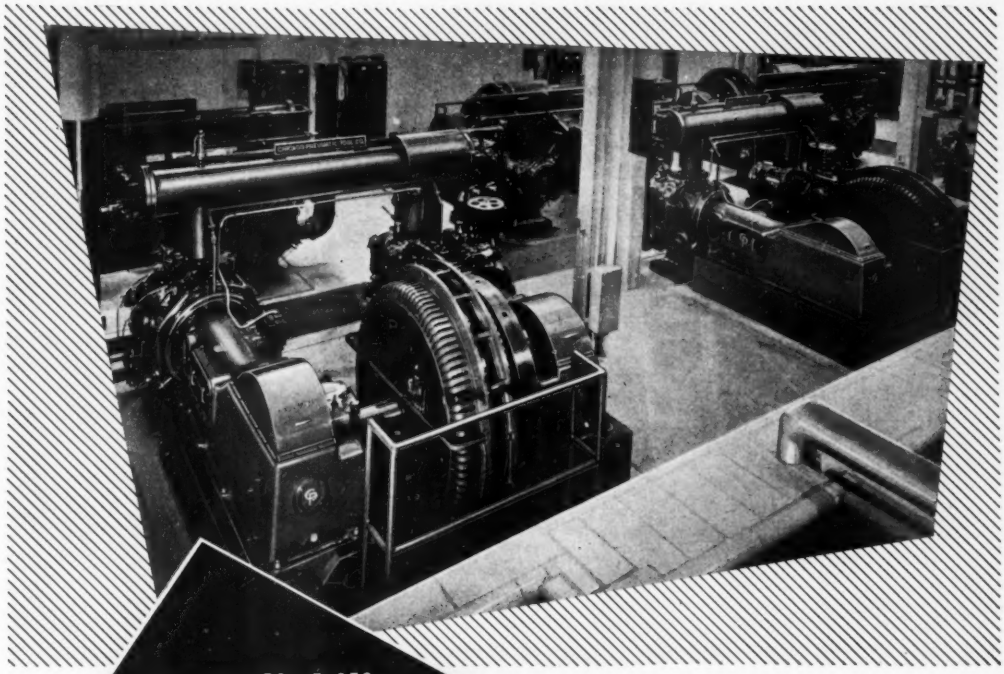
T Spencer Shore becomes president of **Eagle-Picher Co,** Cincinnati, Ohio. Joel M Bowlby, in addition to continuing as chief executive officer and general manager of operations, is also chairman of the board now. Joseph Hummel Jr is honorary chairman. Elmer Isern is promoted to president of the subsidiary, Eagle-Picher Mining & Smelting Co.

Hagan Corp transfers its offices and laboratories to Manufacturers' Agents Exhibit Bldg, San Francisco 11, Calif. The new technical facilities will be used jointly by Hagan and its subsidiaries—Hall Laboratories and Calgon, Inc. Special analytical work or unusual service problems will be referred to Hagan's main offices in Pittsburgh, Pa.

William J McGraw is manager of Cleveland branch of **Independent Pneumatic Tool Co.** Ed B Rosell succeeds McGraw as manager of electric tool sales in the New York territory.

Jessop Steel Co, Washington, Pa., announces following appointments: Frank B Rackley is vice-president in charge of sales, and Curtis A Gordon vice-president in charge of operations. E E Bradberry is assistant manager of sales in Chicago, with offices at 332 S Michigan Ave. Howard M Dawson is elected president of the firm's subsidiary, Jessop Steel International Corp, 75 West St, New York City.

A Los Angeles warehouse and office of **Raybestos-Manhattan, Inc,** is at 4651 Pacific Blvd. It services and stocks rubber goods and packings for industrial and oil field requirements for southern California.



For reliability and economy

O-CE Compressors

For the steady, heavy-duty job the CP motor-driven O-CE Compressor is ideal because of its rugged construction, conservative rating and low power consumption.

Its excellent features include: quick-acting Simplate valves that minimize power consumption and provide high volumetric efficiency . . . large, streamlined air passages that make air flow resistance negligible . . . the CP Multi-Step Control for handling partial load demands with economy . . . the CP Intercooler that assures maximum heat transfer with low water consumption . . . and the CP Automatic Starting Unloader that completely unloads compressor when starting and stopping.

The Chicago Pneumatic Class O-CE Compressor is of the horizontal, double-acting, water-cooled type, with direct-mounted synchronous motor drive; in sizes up to 1,750 h.p., for pressures up to 5,000 pounds.

Write for full information.

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General Offices: 8 East 44th Street, New York 17, N. Y.

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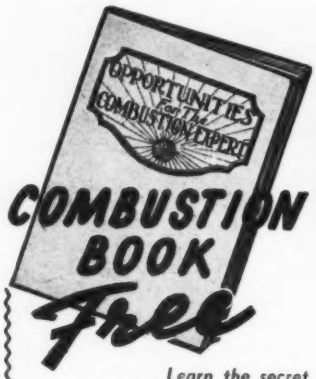
DIESEL ENGINES • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



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High power plant costs today have opened up big opportunities for men who know the means of producing efficiency and economy in power plant operation. The above booklet, sent to you without obligation, will tell you of the easy way to become a Hays trained Combustion Engineer, in a little of your spare time, through the easy reading, low cost, Hays Home Study Course in Fuel and Combustion Engineering. Send for it now.

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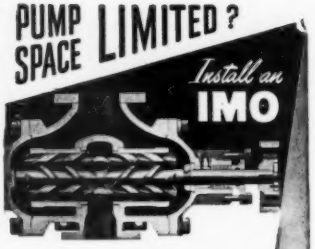

- The capacity of the IMO is increased by high speed operation. This compact pump can be directly connected to the driving machine without bulky speed reduction gearing.
- IMO Pumps can be furnished for practically any capacity and pressure required for oil, hydraulic-control fluids and other liquids.

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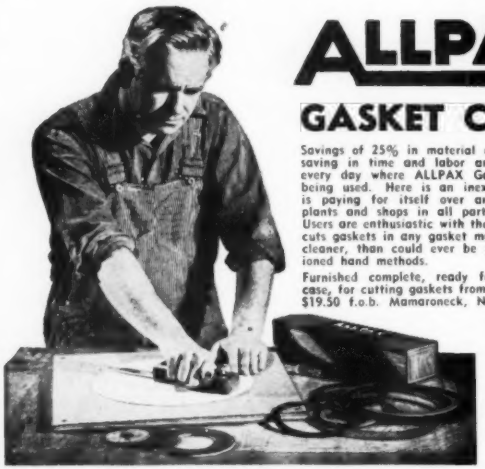
Save Time, Material and Labor . . . . .
by cutting gaskets the modern way



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GASKET CUTTER

Savings of 25% in material and a tremendous saving in time and labor are being recorded every day where ALLPAX Gasket Cutters are being used. Here is an inexpensive tool that is paying for itself over and over again in plants and shops in all parts of the country. Users are enthusiastic with the way the ALLPAX cuts gaskets in any gasket material faster, and cleaner, than could ever be done by old-fashioned hand methods.

Furnished complete, ready for use, in metal case, for cutting gaskets from 1" to 36". Price $19.50 f.o.b. Mamaroneck, N. Y.

30-DAY FREE TRIAL OFFER

Write for details.

THE ALLPAX CO., INC. *Mamaroneck, N.Y.*

Schuyler V V Hoffman is in charge of the warehouse. Frank W Sauger, equipment sales, West Coast div, also makes his headquarters at above address.

Harry P Smith has been made assistant general manager of sales for **Mathieson Chemical Corp.** His headquarters remain in the firm's New York officers.

R J Denton Co, Syracuse, N. Y., has been chosen as distributor of Apexior and Thur-Ma-Lox protective coatings for **Dampney Co of America,** Boston, in the Syracuse area.

H K Ferguson Co announces establishment of a Chicago sales office. It is managed by L Douglas Lacy and located at 120 S LaSalle St.

All Western sales activities are now to be coordinated and directed by L G Maechtlen, who has been made general sales manager of **Square D Co,** western div.

Caterpillar Tractor Co, Peoria, Ill., names Fred V Jacobs supervisor of engine advertising and William Kusz supervisor of industrial advertising. Kusz succeeds K M Emery, who becomes supervisor of cooperative dealer advertising.

Appointments of six sales representatives to **Allis-Chalmers** district offices are as follows: J I Onarheim and R T Ward are assigned to Milwaukee; Jay Seefeld to San Antonio; W H Sanford to Houston; A Joseph Mestier Jr. to New York as petroleum sales representative; and Robert E Bender to Grand Rapids.

Fisher Governor Co, Marshalltown, Iowa, announces A E Ehrke & Co, 5005 Euclid Ave, Cleveland 3 Ohio, as its district sales representative in the Cleveland area. Bill Sixt and F L Zehe, formerly of Tomlinson Co who previously represented Fisher, are now associated with Ehrke.

Thomas B Moule was promoted to sales manager of **Plomb Tool Co,** Los Angeles, Calif.

Sun Oil Co, Philadelphia, has named Ray H Anders director of purchases to succeed Henry Thomas, who has retired. Anders will be assisted by Roy A. Hurst.

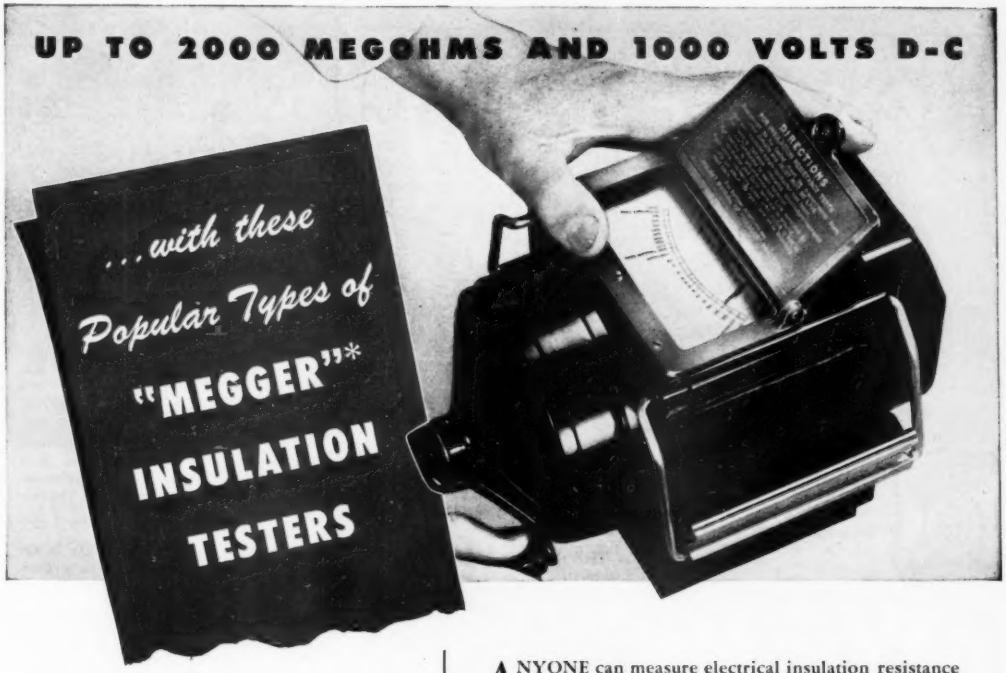
C P Cryer is in charge of the branch office opened in Baltimore, Md., by machinery div of **Dravo Corp, Pittsburgh.** The office represents De Laval Steam Turbine Co, Askania Regulator Co, and Davis Engrg Co. It is located at 100 N Eutaw St.

Corning Glass Works, Corning, N. Y., appoints Preston M Reynolds manager of advertising and sales promotion for technical products div.

W D Jewett, export manager of Dominion Bridge Co, Ltd, Montreal, has been elected president of **Canadian Exporters' Assn.**

Bituminous Coal Research, Inc. has opened a branch office at 488 W Sixth Ave, Columbus 1, Ohio. Elmer R Kaiser, as-

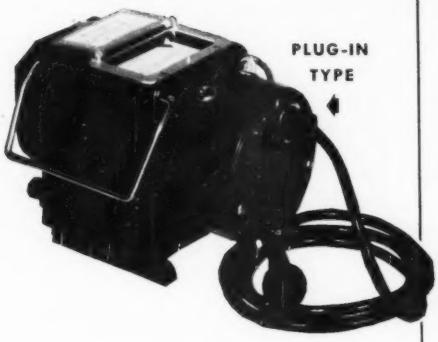
UP TO 2000 MEGOHMS AND 1000 VOLTS D-C



ANYONE can measure electrical insulation resistance in generators, motors, wiring and other electrical equipment with a "Megger" Insulation Tester . . . quickly . . . easily. Merely make connections, turn the crank and read the position of the pointer on the scale.

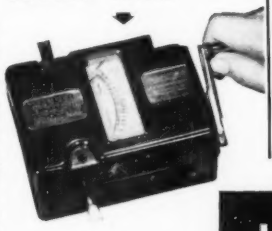
The "Megger" instrument shown above consists essentially of a direct-reading ohmmeter mounted with a constant-voltage d-c hand generator in a rugged molded plastic case. It is conveniently small . . . can be easily carried by hand. It operates unfailingly, anywhere, anytime . . . without outside power supply or adjustments. And, it provides you with insurance against electrical failures.

Other "Megger" Insulation Testers are available in various types with ratings up to 10,000 megohms and 2500 volts d-c. Write for descriptive illustrated Bulletin 21-45-P.



● For those who need or prefer a "Megger" Insulation Tester that can be "plugged-in" instead of hand-cranked, we present the *rectifier-operated* instrument illustrated above. Simply connect to 115 volts a-c, flip a switch and proceed to make tests. It is especially useful where a number of tests are to be made at one time. A "power pack" consisting of a constant-potential step-up transformer and selenium rectifier, provides constant d-c test voltage. The "Megger" true ohmmeter covers a wide range and is independent of the supply voltage. A switch, pilot light and connecting cable are included. Available in various ratings up to 2000 megohms and 1000 volts. Ask for Bulletin 21-46-P.

"MIDGET MEGGER" TESTER



. . . with the same essential features: used for detecting and diagnosing trouble in nearly all types of electrical equipment. Ratings up to 50 megohms and 500 volts variable voltage. It's a convenient answer to many of your electrical insulation problems. Write today for Bulletin 21-75-P.

*REG. U. S. PAT. OFF.

JAMES G. BIDDLE CO.

Electrical & Scientific Instruments

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PUMP IT *with a* VIKING

If your problem is to pump any of these or similar liquids, look to Viking for your answer. Capacities ½ to 1050 gpm—pressures to 200 psi.—500 psi on hydraulic oils.

Send for free bulletin 47SW today.

See Our Catalog In SWEETS

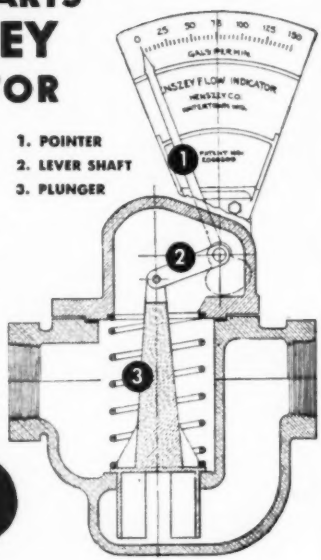
Viking PUMP COMPANY
Cedar Falls, Iowa

Only 3 MOVING PARTS *in the* HENSZEY FLOW INDICATOR

There are only three moving parts in the Henszey Flow Indicator—the Pointer, the Lever Shaft and the Plunger. And that means longer wear, continued service, and constant accuracy.

The liquid enters the indicator below the plunger, forcing the plunger upward. Slots in the side of the plunger allow the liquid to pass. Increased flow will increase the lift, exposing a greater area of the slots, so that the lift of the plunger is in direct proportion to the rate of flow of the liquid. The graduations on the dial are uniformly spaced from one end to another and read direct—without constants. The entire instrument can be installed right in the pipe line.

1. POINTER
2. LEVER SHAFT
3. PLUNGER



Send for Bulletin F1-1

HENSZEY COMPANY

Dept. D-1, WATERTOWN, WISCONSIN

HENSZEY FLOW INDICATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

sistant director of research, will be in charge, and assisting will be James R Garvey, development engineer.

Guy W Witmer is now chief engineer at Riverside plant of **Savannah Electric & Power Co,** succeeding Arthur J Monnen, who retired. Witmer is succeeded by E W Gracen as assistant chief engineer.

Kansas City Power & Light Co discloses the establishment of two new departments in the company's operating div: J S Palmer directs new system planning dept, and C M Lytle fills newly created post of chief engineer of transmission and distribution. Also, C C Cornelius becomes manager of overhead systems and assistant to Fred J Gunther, manager of operations; S H Pollock is assistant superintendent of overhead dept; J Clark Davis becomes assistant transmission and distribution engineer; H F Dougherty is promoted to assistant superintendent of transportation dept; I T Knight and J O Spencer become superintendent and assistant superintendent, respectively, substation dept.

Bethune L Smith, K C, a partner in the law firm of Smith, Rae, Greer and Cartwright, is named president of **Canadian Niagara Power Co, Ltd.** Also named are: A T O'Neill, president of Buffalo Niagara Electric Corp.,—a vice-president; Walter S Schmidt, Buffalo,—secretary; Charles A Clancy, Niagara Falls,—vice-president and general manager; and Mary Louise Bottomley, Niagara Falls, Ont.—assistant secretary. A vacancy on the board of directors resulting from the death of John E Lawson is filled by Charles L Gundy, Toronto, president and a director of Wood, Gundy & Co, Ltd. All other members of the board are reelected.

Dr Kenneth C D Hickman concludes arrangements by which he will serve both **Eastman Kodak Co,** Rochester, N. Y., and **Arthur D Little, Inc,** Cambridge, Mass., as consultant. Hickman may be addressed at his home, 56 Thackery Rd, Rochester, N. Y., or at Little.

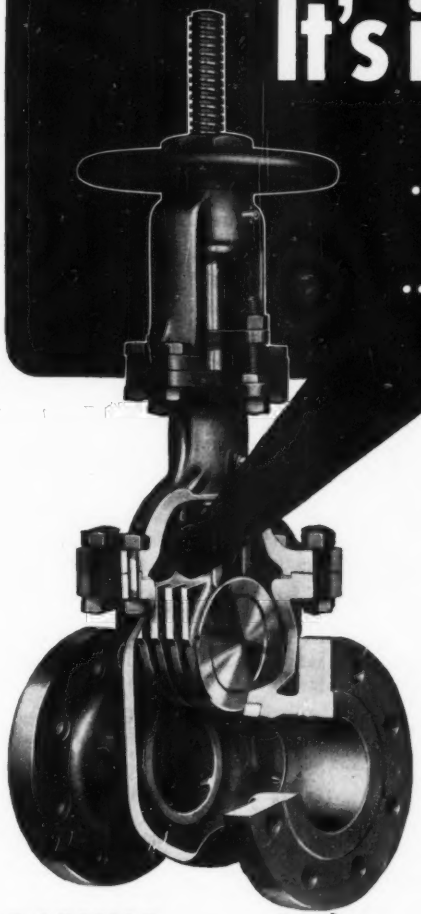
American Society of Mechanical Engineers elects James M Todd, consulting engineer of New Orleans, its president. He continues in office until the 1949 annual meeting. Other officers elected by ASME are: As regional vice-presidents to serve two years—Arthur Robert Jr, chief engineer, Lynchburg Foundry Co, Lynchburg, Va.; Forrest Nagler, chief mechanical engineer, Allis-Chalmers Mfg Co, Milwaukee; Carl J Eckhardt, professor of mechanical engineering and superintendent of utilities, University of Texas, Austin; Albert R Mumford, development engineer, Combustion Engrg Co, New York City. As directors-at-large to serve four years—Jacob A Keeth, manager of power production, Kansas State Power & Light Co, Kansas City, Kansas; Ralph A Sherman, assistant director, Battelle Memorial Institute, Columbus, Ohio.

At the annual meeting of **United Engineering Trustees, Inc,** the following officers have been elected: Edward C

It's in the groove!

...less maintenance

...better performance



DARLING
Slotted Wedge
CAST STEEL GATE VALVES

SEEMINGLY small details of valve design can have a big effect on over-all valve performance . . . and on your pocketbook.

For example, look how the slotted wedge of this Darling cast steel gate valve is *double*-grooved, guided throughout its travel by corresponding twin ribs on each side of the valve body. This extra bearing area is a key factor in the perfect, lasting alignment of all parts. And, perfect alignment, together with the slotted wedge feature, makes it unnecessary to "reseat" the wedge at each closing and requires less force. Wedges and seats last longer, need less maintenance. Performance is more reliable. You save time and money.

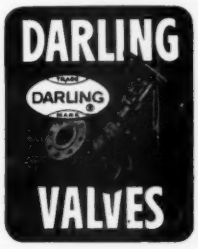
Add several other equally effective Darling features and you'll see why Darling users swear by these rugged, trouble-free valves.

Wouldn't it be a good idea to get *complete* information? Simply specify your particular service requirements . . . or, send for the 300-page Darling Catalog No. 17M. It describes Darling Valves of *all* types and sizes . . . and is full of data of general value . . . yours for the asking.

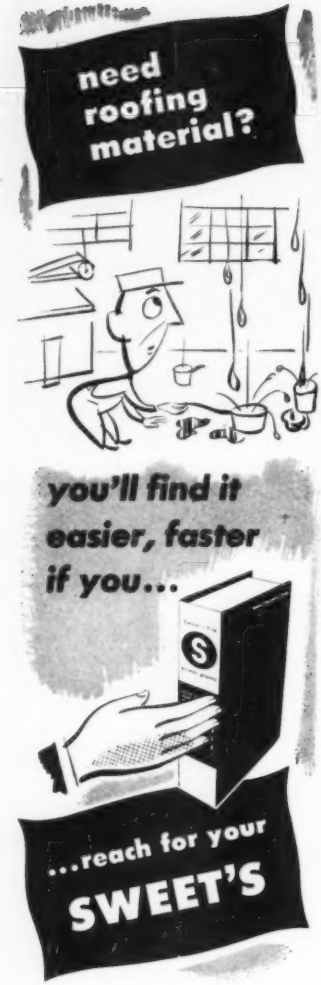
Darling Gate Valves are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 3000 pounds. In addition to the slotted *wedge types, there are solid wedge taper seat valves and the famous Darling Fully Revolving Double Disc Parallel Seat Gate Valves for virtually any service.*

DARLING VALVE
AND MANUFACTURING CO.

WILLIAMSPORT 8, PA.



THE VALVE MARK OF QUALITY . . . WATCH FOR IT



When you need specific information on materials or equipment, reach for your Sweet's File for Power Plants (the big red file). It contains 118 manufacturers' catalogs full of useful information on thousands of products...from absorbers—gas, to zeolite. Cross indexing speeds finding.

If Sweet's File for Power Plants is not available in your office, make request immediately for application form. Files are distributed FREE to qualified organizations and individuals.

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for easier, faster selection of products

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Meagher, treasurer, Texas Gulf Sulphur Co, New York—*president;* James F Fairman (AIEE), vice-president, Consolidated Edison Co of New York, and Irving Huie (ASCE), president, Board of Water Supply, New York,—*vice-presidents;* Kurt W Jappe, treasurer of ASME,—*treasurer;* James L Head (AIME), Dept of Mines, Chile Exploration Co, New York,—*assistant treasurer;* John H R Arms (AIME, ASME),—*secretary.* Colonel William N Carey, secretary of ASCE, will head the real estate committee. George W Burpee (ASCE), consulting engineer, New York, will serve as chairman of finance committee. Warner Seely (ASME), secretary, Warner & Swasey Co, Cleveland, has been elected to board of directors.

George N Sieger, president of S-M-S Corp, Detroit, directs activities of **American Welding Society.** Sieger is president of the society for 1948-49.

Cornell University consolidates its departments of engineering materials in School of Civil Engineering and in Sibley School of Mechanical Engineering into a new dept of engineering materials. Dr D F Gunder, professor of mechanics, is acting head of the dept. In addition, Prof Erik K Hendriksen is now head of dept of materials processing in Sibley School of Mechanical Engineering. Cornell also announces that Dr Pio Franco Martinuzzi joins the staff in February as a professor of mechanical engineering.

Colonel John Slezak, president, Turner Brass Works, Sycamore, Ill., has been elected to membership on the board of trustees of **Illinois Institute of Technology.**

Columbia University's School of Engineering names Prof Carl F Kayan head of dept of mechanical engineering. Prof Theodore Baumeister, who resigned the post last July, continues as a member of the faculty.

OBITUARIES

Aldus C Higgins, 76, chairman of executive committee, Norton Co, Worcester, Mass., died Sept 10.

Raymond A Eck, 57, stationary engineer for Marine Trust Co Bldg, Buffalo, died Oct 29 after an illness of seven months.

Max Kliefoth, 57 chemical engineer and vice-president of Research Products Co, Madison, Wis., died Oct 25 at his home in Woodward Grove.

A Donald May, 55, former district engineer of Central New York Power Corp in Watertown and Potsdam, died Nov 13 in General Hospital of Syracuse.

City Utility Commission, 412 Frederica St, Owensboro, Ky. received bids Oct 20 on improvement to boiler building of the municipal power plant as follows: reinforced-concrete brick-and-steel extension of the building to house one additional boiler. Black and Veatch, 4706 Broadway, Kansas City, Mo. are the consulting engineers.

Call in OAKITE TECHNICAL SERVICE

Whenever You Need Help In Solving A Difficult Maintenance Cleaning Job

Whenever you are confronted with a particularly difficult maintenance cleaning problem . . . or whenever you would like to know whether or not you can reduce your present cleaning costs, put your problem up to us. Call in Oakite Technical Service. Let an Oakite Representative study your conditions at first hand, and, on the basis of his findings, recommend the cleaning and sanitation practices that will best meet your needs.

Oakite welcomes the opportunity to place at your disposal all their technical service facilities, including:

1 **NATIONWIDE PERSONALIZED SERVICE,** in industrial centers throughout the U.S. and Canada.

2 **OVER 70 MATERIALS;** alkalines, acidics, solvents, germicidals, deodorants.

3 **HELPFUL TECHNICAL LITERATURE,** including Manuals, Digests, Field Service Reports.

4 **FORTY YEARS' EXPERIENCE,** solving cleaning problems of all industries.

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Any of these services are always available to you without cost or obligation. Consult Oakite with confidence.

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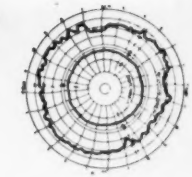
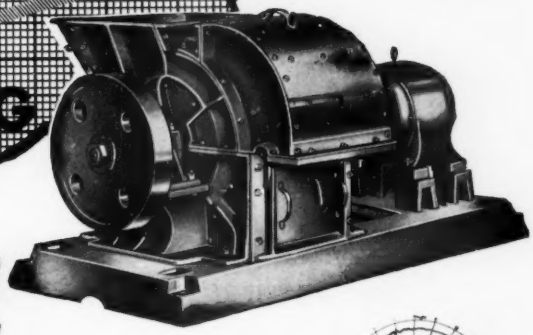
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* **CLEANING**
MATERIALS • METHODS • SERVICE

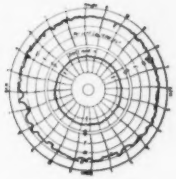
INCREASE COMBUSTION EFFICIENCY through UNIFORM COAL SIZING



Improper Crushing



with AMERICAN *ROLLING RING* CRUSHERS



Uniform Crushing by Americans

Stoking with coal uniformly sized by American Crushers increases firing efficiency (as recorded with CO_2 charts) from 2½ to 8% over coal prepared in conventional crushers. This has been proven by a series of impartial 24 hour operating tests run by an independent agency (name on request). The quality of the crushing is actually more important than the quality of the coal in efficiency of combustion.

In American Rolling Ring Crushers, ROM and Lump sizes are rapidly reduced to stoker or pulverizer sizes with minimum fines and no oversize at a cost of less than 1c a ton. Americans provide a compact, complete crushing operation in minimum headroom with no auxiliary crushing operations or equipment necessary — no extra picking and standby-cleanout labor required.

American Type "S" Crushers, especially designed for power plants, are built in 9 different sizes, with capacities from 25 to 500 TPH.

A patented feature exclusive with Americans, Manganese Steel Shredder Rings split coal instead of crushing it. The multiple cutting edges in the rows of rings on American's heavy rotors give rapid reduction while operating at slow power saving speeds. This makes for uniform sizing and minimum fines. Mounted on individual shafts, the rings are free to deflect from tramp iron without damage.

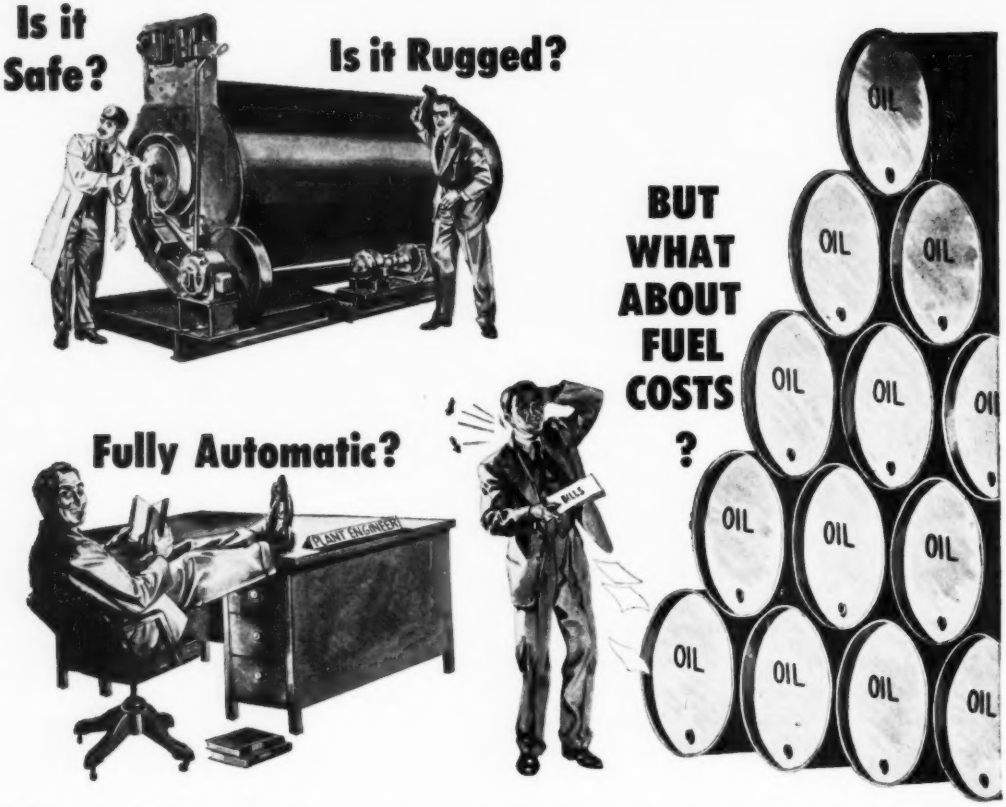
Send for Bulletin "Crushing Coal for Less than 1c a Ton."

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

1349 Macklind Avenue
St. Louis 10, Mo.

How do you test the efficiency of a BOILER?



When judging a boiler, chances are, you have a little quiz session with yourself. After checking its external appearance, rate of steam supply, and safety features, you ask the jackpot question: does it generate steam *economically?*

If a boiler does not produce steam with minimum fuel, it eats into profits. To avoid soaring steam costs, more and more architects and engineers are specifying modern Preferred Unit Steam Generators. These units often cut fuel bills as much as 40% . . . keep maintenance bills low for years . . . eliminate costly unexpected shutdowns . . . minimize operator attention.

You can count on this low-cost, trouble-free operation because Preferred is the *only* factory-completed steam generator with *all* these features:

1. Fully Automatic Oil Operation even with No. 6, Bunker C, including the new catalytic residuals.

2. Induced (Pull-through) Draft, a distinctive feature, eliminating the necessity of building costly stacks. Only a simple vent to the outside air required. No escape of products of combustion into the boiler room.

3. Preferred Oil Burner — built especially for this unit.

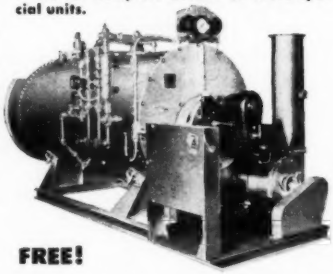
4. Four-Pass Gas Travel results in maximum heat absorption.

5. 80% Minimum Thermal Efficiency proved and guaranteed.

6. Low Maintenance — the result of over 27 years of combustion engineering experience.

7. Full Range of Sizes — from 20 to 500 hp. and pressures of 15 to 200 lb. Two-pass units in 20 and 30 hp. with pressure of 15 lb.

Four-pass units for higher pressures also available in all sizes on special order. Write for complete details of these special units.



FREE!

Bulletin 1000-F and latest Fuel Savings Sheet gives all the facts on the Preferred Unit Steam Generator. Write for your copies today.

P-1-49

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PREFERRED UTILITIES MFG. CORP.

YOU CAN GO

Up and Up!

. . . with Square Copper Tube Bus Conductors made by Chase

YES, the square construction of Chase Copper Tube Bus Conductors, provides high mechanical strength in all directions . . . and enables you to install a conductor taller than ever before.

Since Chase Square Copper Tubes have four flat sides, they allow adequate and uniform pressure to be exerted between the large contact surfaces, resulting in *firm, secure joints.* In addition to these advantages—great mechanical strength, ability to make efficient joints and connections—this Chase product is high in electrical and thermal conductivity . . . has high current-carrying capacity . . . is greatly resistant to corrosion.

Write today for informative booklet! Address Chase Brass & Copper Co., Dept. PO19.

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THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

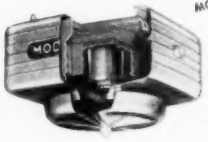
ALBANY ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER SAN FRANCISCO SEATTLE ST. LOUIS WATERBURY (Limited-to Sales Office Only)

To everyone about to order unit heaters, Modine says,

"Look before you buy!"

MODINE MAKES THIS SPECIAL OFFER!

Now you can check Modine's quality features . . . *without leaving your office.* Call your Modine Representative today to show you an actual Modine Unit Heater . . . to explain its advantages in detail. You'll like its attractive appearance, sound engineering, rugged construction. Examine Modine—compare it with other unit heaters before you make your decision.



MOTOR AND FAN REMOVABLE

MOTOR PROTECTED FROM CONDENSER RADIANT HEAT

HARMONIZES WITH MODERN INTERIORS

Look at Modine Power!

See how motors must meet rigid performance requirements before they can team up with Modine Unit Heaters. Check motor's heavy-duty, totally enclosed construction. See how it's rubber-mounted, noise-proofed for silent service.

HORIZONTAL VERTICAL POWER-THROW

Look at Modine Line!

See how Modine's complete line of three distinct types and 47 basic capacities can solve your specific space heating problems. Find out how there's a Modine Unit Heater for every industrial or commercial need.

YES, look before you buy.. and you'll buy Modine!

Guesswork is gone from unit heater buying when you compare Modine with all other makes. Yes—your best judgment will tell you Modine is the leader—the only unit heater which gives you ALL these important features. Modern Beauty . . . Individual Tube Expansion . . . Velocity Generator . . . Rugged Safety Fan Guard . . . Patented Direct Suspension . . . Built-in Air Control Device. What's more, you can choose from three types and 47 capacities to meet your specific heat, air delivery, height and location needs.

When you look before you buy, you'll see why Modine leads the field. Call your Modine Representative for further details. He's listed in the "Where-to-Buy-it" section of your phone book. Or write direct for Modine's new 52-page catalog. Modine Manufacturing Company, 1512 Dekoven Avenue, Racine, Wisconsin.

Modine UNIT HEATERS

A Cottrell Precipitator Installed by Research Corporation

WILL COLLECT OVER

95%

OF YOUR FLY ASH

A Research Corporation Cottrell will effectively clean stack gases by removing over 95% of all the different size fly ash particles suspended in the gas.

It will operate with a low draft loss, averaging only a few tenths of an inch of water across the Cottrell. The electrical power required for energizing the Cottrell is extremely low, amounting to only .5 to 1.0 KWH per 100,000 cubic feet of gas cleaned.

The *plus* efficiency of Research-installed Cottrells is assured by Research's experience gained in over 35 years and 1100 installations. This knowledge is essential to successful dust control, for every application presents its own peculiar problems. Each installation must be individually engineered.

Research-Cottrells can be installed to furnish any degree of efficiency desired, and to handle any volume of boiler gas. Full information is presented in an interesting 28-page bulletin. Write for your copy today.

Research Corporation Installations

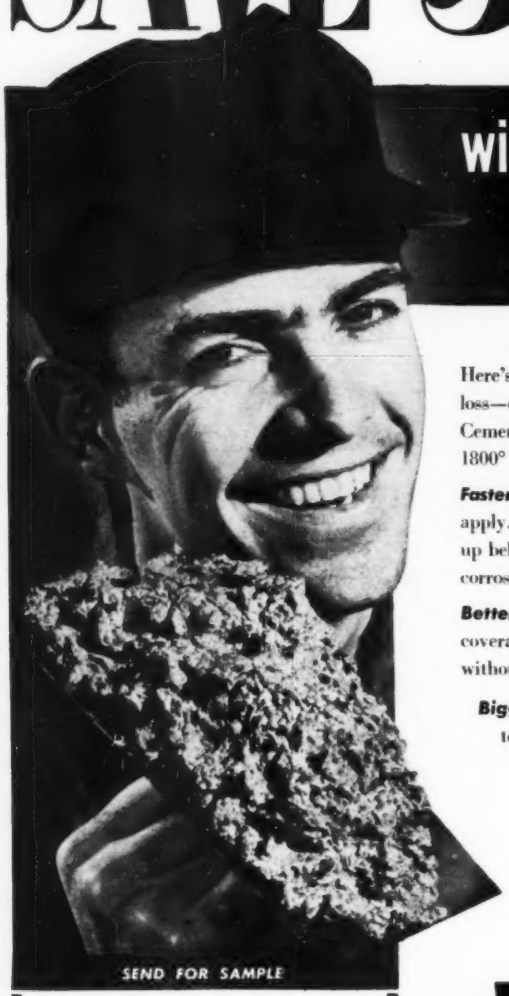
47 CARBON BLACK PLANTS
200 METALLURGICAL INSTALLATIONS
203 ACID PLANTS • 34 PAPER MILLS
262 DETARRING INSTALLATIONS
195 POWER STATIONS
71 STEEL PLANTS • 95 OIL REFINERIES
AND MISCELLANEOUS INSTALLATIONS

RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois

SAVE 3 Ways

with B-H No. 1 Cement
for insulating valves and other irregular surfaces



Here's the insulating cement that makes it practical to stop heat loss—even on areas that must be occasionally serviced. B-H No. 1 Cement is efficient, easy to use and resists temperatures up to 1800° F.

Faster to use. With B-H No. 1, you simply add water, mix and apply. *It sticks instantly!* It won't slide off bottom surfaces or roll up behind the trowel. Special rust inhibitor prevents pitting and corrosion.

Better coverage. B-H No. 1 is economical to use—with a wet coverage up to 60 square feet, 1-inch thick per 100 pounds! It dries without cracking or peeling. And it's reclaimable up to 1200° F.

Bigger heat savings. B-H No. 1 stops heat loss, even at high temperatures—because it's compounded of *black* Rockwool. For example, a 3-inch application reduces 800° F to 150° F.

There are hundreds of places where you can turn heat losses into profits with B-H No. 1 Cement. Send the coupon for descriptive literature and a working sample.

SEND FOR SAMPLE

BALDWIN-HILL COMPANY
734 dreunig Avenue, Trenton 2, N. J.

Send free sample of B-H No. 1 Cement and 24-page data book "Industrial Relations."

NAME..... POSITION.....

FIRM.....

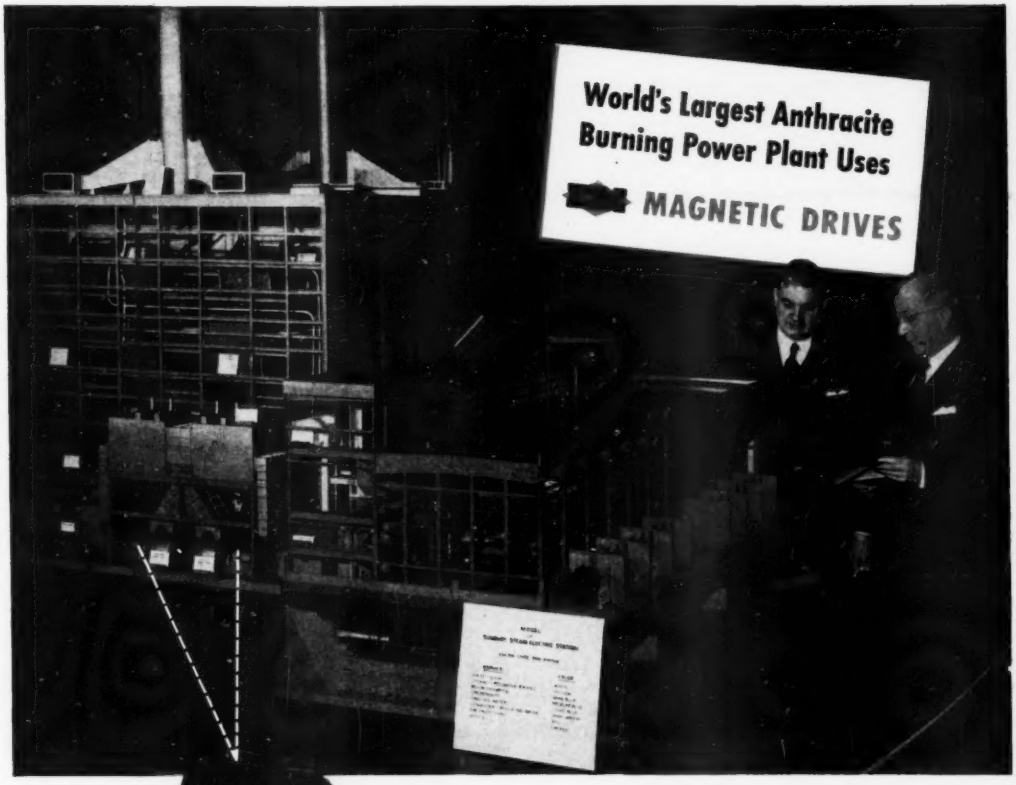
ADDRESS.....

.....

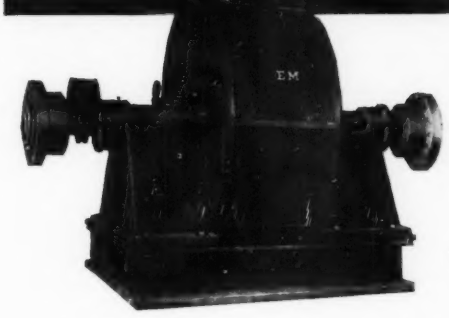
Baldwin-Hill

Specialists in Thermal Insulation

B-H MONO-BLOCK | B-H BLANKETS | B-H WEATHERSEAL | B-H FELTS



President Chas. E. Oakes, left, and Vice-President George M. Keenan examine model of 150,000 kw. Sunbury Station.



DETAILED SCALE MODEL illustrates planned construction of Sunbury Station of Pennsylvania Power & Light Company near Sunbury, Pa., where eight 635 hp., 840 rpm., E-M Magnetic Drives with Regutron Control are being installed to regulate induced draft fans.

At the Sunbury Plant of the Pennsylvania Power & Light Company, as in many other power plants, E-M Magnetic Drives with Regutron Control have been specified to provide precise, wide-range control of boiler draft fans, to save fuel and power, to prolong fan life and assure smooth, quiet fan operation.

Full information on E-M Magnetic Drives is available through your nearest E-M field engineer. Or write directly to us for Bulletin titled "Precision Speed Control for Boiler Draft Fans with Regutron-Controlled Magnetic Drive", written by our chief application engineer. Just ask for Publication 1078.

ELECTRIC MACHINERY MFG. COMPANY
Minneapolis 13, Minnesota

4400-TPA-2082

E-M
ADJUSTABLE-SPEED MAGNETIC DRIVES

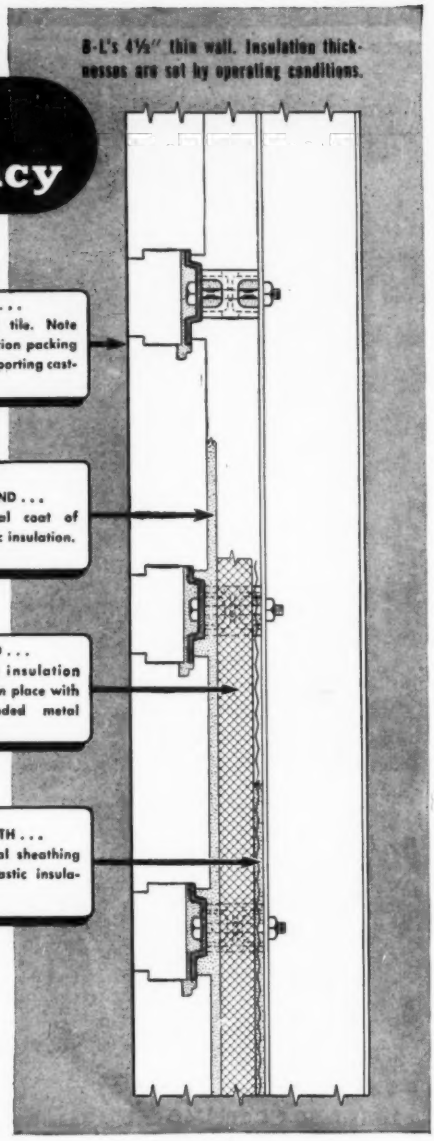
suspended enclosures boost furnace efficiency

• To provide peak industrial furnace efficiency, B-L suspended enclosures include a four-ply seal—designed to keep heat in, air out.

The secret? The necessary, yet economical, amount of insulation applied according to Bigelow-Liptak's rigid specifications as to material and technique. Tile construction, first, is completely offset so that there is no straight through joint in the enclosure. Over the tile is spread a coat of plastic insulation. Block insulation, held in place by expanded metal lath, provides another line of defense. Anticipated service conditions set block thicknesses. Finally, an overall sheathing of plastic insulation completes the seal. And the result: a mimimum of heat loss and air infiltration.

Unit-suspended construction insures unbroken insulation. Blocks tie in to castings and are not affected by tile movements. Castings are completely buried in the insulation to avoid heat drainage. Only point contact spacers extend through to the outside steel.

Bigelow-Liptak unit-suspended walls and arches are used in power plants, for boiler settings; in refineries, for oil heaters and vessel linings; for all kinds of driers and kilns and metallurgical furnaces.


B-L's 4½" thin wall. Insulation thicknesses are set by operating conditions.
FIRST . . . Offset tile. Note insulation packing in supporting casting.
SECOND . . . A seal coat of plastic insulation.
THIRD . . . Block insulation held in place with expanded metal lath.
FOURTH . . . A final sheathing of plastic insulation.

Here's more of the Bigelow-Liptak story:

1. Walls and arches feature "built in" stability; any portion can be removed for replacement without weakening adjacent areas. Design provides for thermal expansion.
2. Refractories are easy to replace without disturbing undamaged sections. Maintenance is simple, quick, economical.
3. Unit suspension permits flexible design, eliminates cumulative loading.
4. B-L engineers co-ordinate enclosure requirements with problems of temperatures, types of firing equipment, and slagging and erosion possibilities.

Write today for more information.

PIONEERS OF SUSPENDED CONSTRUCTION FOR INDUSTRIAL FURNACE ENCLOSURES . . .

BIGELOW LIPTAK Corporation

BIGELOW-LIPTAK

Unit-Suspended Walls & Arches

DIVISION OF A. P. GREEN FIREBRICK CO.

CURTIS BUILDING • DETROIT 2, MICHIGAN

IN CANADA

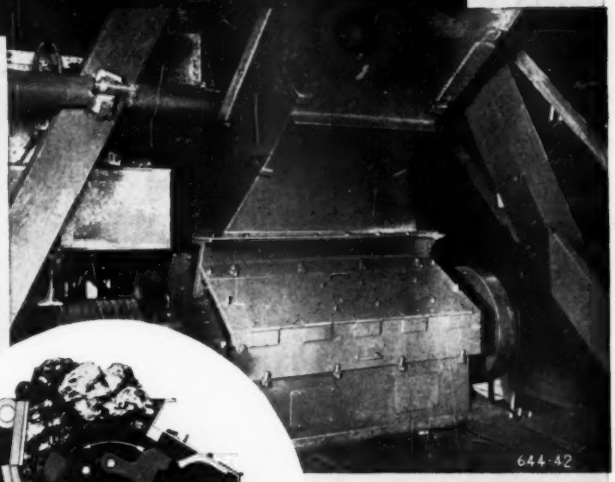
BIGELOW-LIPTAK OF CANADA, LTD., TORONTO, ONTARIO

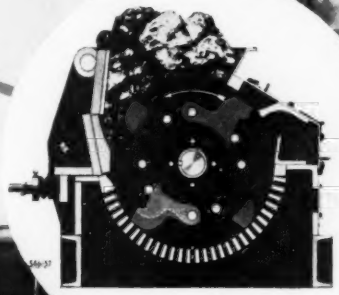
DETROIT · CHICAGO · NEW YORK · SEATTLE · SALT LAKE CITY · PHILADELPHIA · MINNEAPOLIS · CLEVELAND · CINCINNATI · PITTSBURGH · SAN FRANCISCO
DENVER · OMAHA · KANSAS CITY, MO. · VANCOUVER, B.C. · HOUSTON · ST. LOUIS · ST. PAUL · BUFFALO · ATLANTA · TULSA · BOSTON · LOS ANGELES

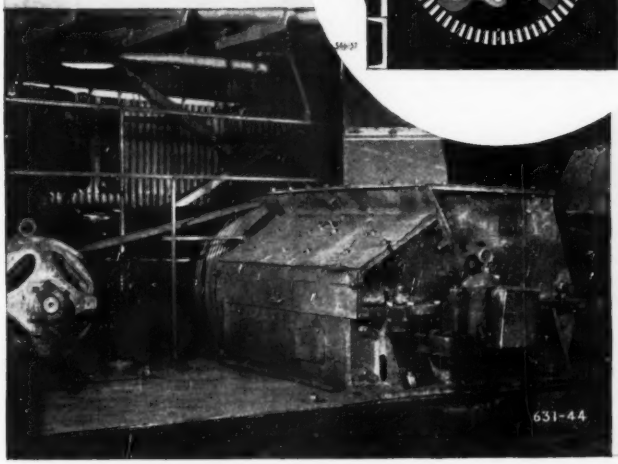
Jeffrey FLEXTOOTH CRUSHER

(PATENTED)

A size for every need







Pick any of ten sizes. Reduce run-of-mine from 2" to ¼" minus with either low or high percentage of fines. Quickly adjustable. Teeth held in position by centrifugal force. Flexing principle permits them to swing away when contacting tramp iron.

Catalog No. 706

THE JEFFREY MANUFACTURING COMPANY

832 North Fourth St., Columbus 16, Ohio

ESTABLISHED 1877

Complete Line of Material Handling, Processing and Mining Equipment

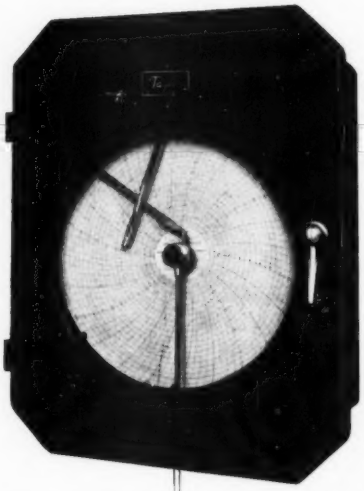
Neither snow nor

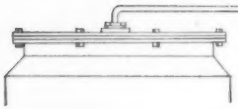
rain nor heat

can bother these

Taylor Accuratus

Thermal Systems





HERE'S a thermal system that gives you all the advantages of mercury actuation on connecting tubing lengths up to 200 feet under almost any conditions *without loss of accuracy!* The reason is Taylor Accuratus Tubing which automatically compensates for ambient temperatures between point of measurement and instrument. Now standard with 18-8 stainless steel from tip of bulb to instrument case.

It has these new advantages:
Corrosion resistant.
Tougher . . . withstands more bending and vibration.
More easily installed . . . more flexible.
More adaptable to limited space . . . bulbs are smaller.

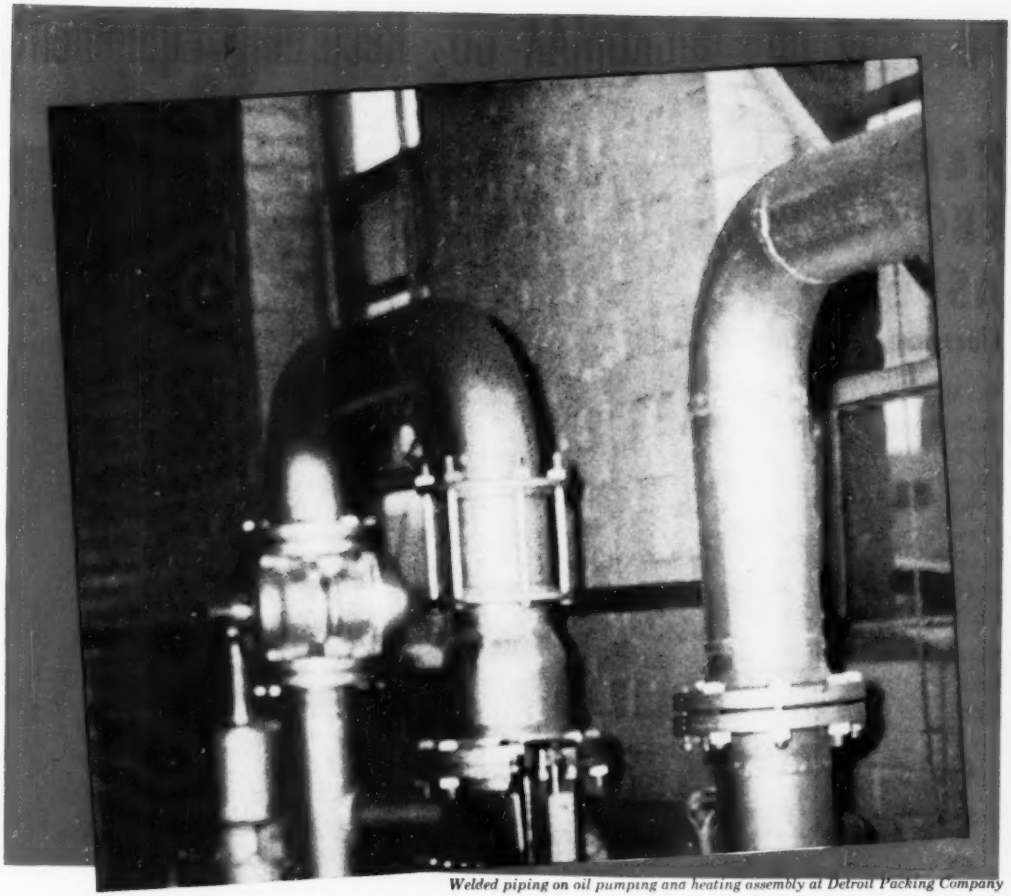
Plus these inherent advantages of Taylor mercury tube system: Uniformly graduated charts; great power and dependability; short ranges within limits of −40° to +1000° F.; low initial cost.

IDEAL FOR APPLICATIONS LIKE:

Steam lines • Desuperheaters • Blowdown lines
Flue gases • Generator air coolers • Condensers
Soot blowers • Feedwater lines • Economizers

We make a complete line of thermal systems—mercury, vapor, gas, organic liquid—each with its own distinct advantages. Whatever temperature problems you face, call your Taylor Field Engineer or send for Catalog 76J. Or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.*

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST



Welded piping on oil pumping and heating assembly at Detroit Packing Company

"Down-time" insurance

THANKS to Tube-Turn seamless welding fittings, steam generating facilities at the Detroit Packing Company are protected against shutdowns through piping failure.

Forming a continuous metal structure with the pipe, Tube-Turn welding elbows provide leakproof joints that represent insurance against maintenance problems for many years to come.

Safe, saving, and permanent, this installation is one of the many thousands upon which the reputation of Tube-Turn welding fittings is founded. Dependable for strength, dimensional accuracy, and adherence to standards, they bear the No. 1 trade name in welding fittings.

Tube-Turn welding fittings come in a wide range of types, sizes, metals, and alloys. Your Tube Turns distributor carries a large stock. For good service in good connections, specify "Tube-Turn".

TUBE TURNS, INC.
236 E. Broadway, Dept. D, Louisville 1, Ky.

District Offices at New York, Philadelphia, Pittsburgh, Chicago, Houston, Tulsa, San Francisco, Los Angeles

Write for data booklet, "Volumetric Capacities of Tube-Turn Welding Fittings."

TUBE-TURN

WELDING FITTINGS AND FLANGES

"Backing up" MICROMAX CO_2 Recording Equipment

K&M EBONIZED ASBESTOS

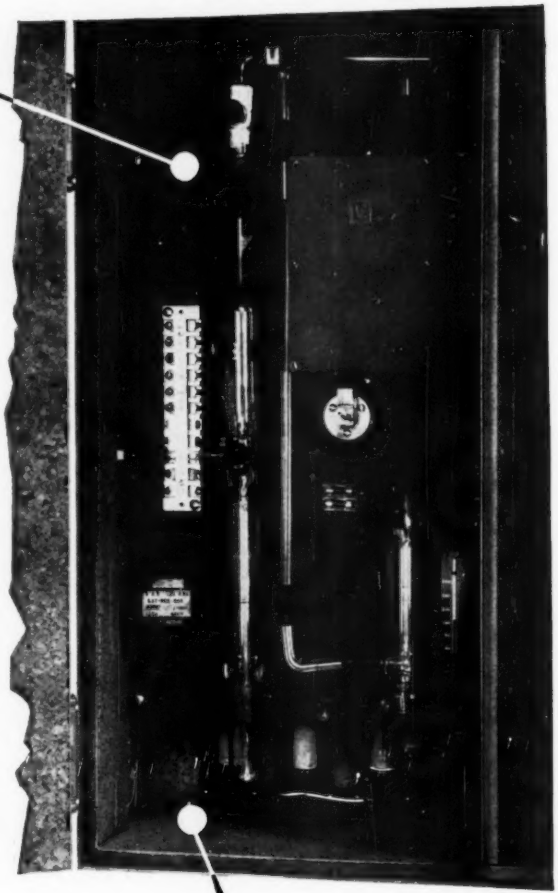
Electrical Mounting Material

The Micromax CO_2 Equipment for flue gas analysis manufactured by Leeds & Northrup Company . . . is a precision industrial unit that accurately detects and records per cent carbon dioxide . . . enabling combustion efficiency to be held at a high level. For added safety and efficiency the components of the CO_2 analysis cell are mounted on K&M Ebonized Asbestos.

More and more engineers are specifying K&M Ebonized Asbestos dielectric mounting material . . . and here are *six reasons why:*

1. Unusually strong—both dielectrically and mechanically.
2. Highly resistant to shock, vibration, temperature changes.
3. Uniform density throughout.
4. Easy to machine, cut, drill and handle.
5. Versatile in use—supplied in various thicknesses up to 4".
6. Neat, efficient appearance in finished units.

(*Photograph courtesy of Leeds & Northrup Co.*)



Ebonized Asbestos is a tough, dense sheet of moulded asbestos fibers, Portland cement and an insulating compound. It meets the technical requirements of Underwriters' Laboratories . . . and will satisfy your requirements in switchboards, bus bar runs, compartment linings, testing tables, bench boards. Write us for more details.

Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

IN CANADA—ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG AND VANCOUVER

K&M best in asbestos

I'M A TWO-HANDED CATCHER!

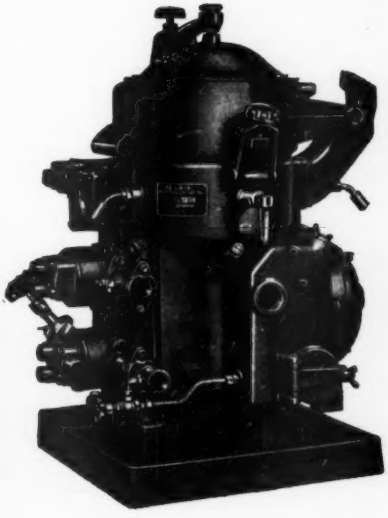
"I am De Laval Centrifugal Force, and when I go to work to remove impurities from lubricating oil, I get rid of ***both*** contaminants — ***dirt*** and ***water***. My centrifugal force throws out every drop of water, which is continuously discharged to waste. Simultaneously I throw out any ***solid*** impurities which are collected in the dirt holding space of the bowl of the centrifuge but out of the way of the oil being purified.

"It makes no difference whether I am asked to purify turbine oil or Diesel oil. Whenever I am on the job, the power plant engineer can be confident that his power plant is protected from trouble at all times.

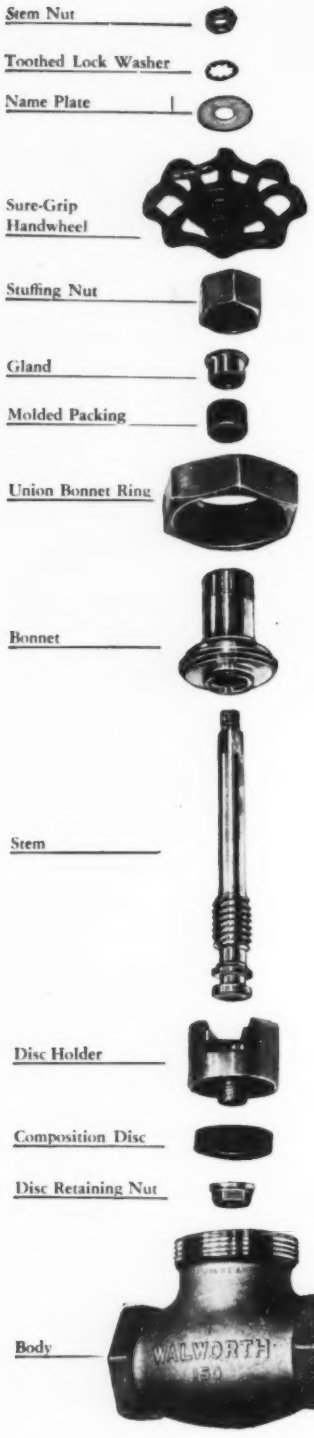
"I am also tops at dehydrating and cleaning Diesel fuel oil. When used for this purpose I enable the operator to get the maximum BTU value from every gallon of fuel oil."

● ***Bulletin TO 1-12 gives you further details. Write for it.***

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.



DE LAVAL
Lubricating Oil Purifiers



TO MAKE A GOOD VALVE BETTER

Walworth has redesigned and improved its No. 95 Quality Bronze Globe Valve.

150 pounds working steam pressure at 500F

300 pounds cold water, oil, or gas.

Can be repacked under pressure when fully opened.

The Walworth No. 95 Bronze Globe Valve has always been tops with piping men because they liked these features: Renewable composition disc; lock-on, slip-off disc holder; union bonnet construction; deep stuffing box; tough bronze body made of Composition M (ASTM B61).

Now Walworth has added these improvements: (1) New cylindrical disc holder that accurately guides the disc to the seat, regardless of the position in which you install the valve. (2) Newly designed, air-cooled, sure-grip handwheel that you can grab and turn, even when wearing greasy work gloves. It has a tapered square hole sized to gage to fit snugly on the finished square of the stem. (3) Toothed lock-washer to prevent the stem nut from becoming loose. (4) All parts have been redesigned to give maximum service and strength.

Walworth Quality Bronze Valves are available in Globe (No. 95), Angle (No. 96), or Check (No. 97) types and in sizes from ¼ to 3 inches (check valves ¼ to 2 inches). Ask your Walworth distributor to show you the improved Walworth No. 95 Bronze Valve, or write for further details.

WALWORTH

valves and fittings

60 EAST 42nd ST., NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

★ HERE'S WHAT REPUBLIC DISTRIBUTORS DO FOR YOU . . .

We are quick to meet our customers' emergency demands

★ *W. C. Hendrie, W. C. Hendrie & Company, Inc. Los Angeles, California*

TOWER SUCTION HOSE—

Smooth Bore for heavy duty service in handling water containing sand and gritty material in suspension, corrosive fluids and mine water.

Rough Bore for heavy duty service in pumping out excavations, flood projects, general contracting, industrial plants. Recommended where water is clear and free from excessive sand and grit, and free from corrosive properties.

Suction Hose quality depends on craftsmanship. Among 1,407 Republic Rubber employees, 147 have a 25 year continuous service record.

Working under Republic Rubber Division's 5-Point Sales Policy, Republic distributors of industrial supplies know the score all of the time. Thus, they carry adequate inventory day in and day out waiting for their customers' emergency calls as well as routine orders.

Republic distributors comprise a group that can be used to advantage for 80% or more of all buying of industrial supplies. Better yet, they have a sales and service policy in line with Republic's 5-Point WRITTEN Sales Pledge. They are responsible people with whom to deal. Do you want to know who this firm is in your territory? Send the coupon or write.

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION . . YOUNGSTOWN, OHIO
Lee DeLuxe Tires & Tubes . . Conshohocken, Pa.

MECHANICAL RUBBER GOODS BY
REPUBLIC RUBBER DIVISION

WHO REPRESENTS REPUBLIC IN MY AREA?
REPUBLIC RUBBER DIVISION . LEE RUBBER & TIRE CORP.
YOUNGSTOWN, OHIO

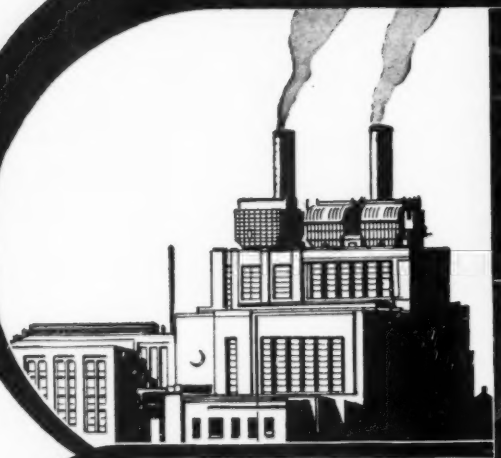
Name, title_____
Firm_____
Address_____
City_____ State_____

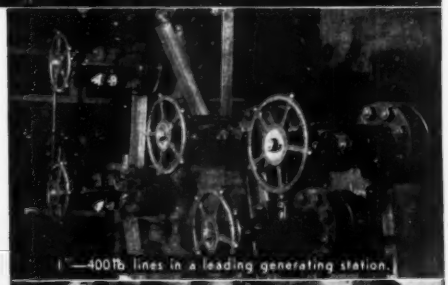
SPECIFY Vogt

DROP FORGED STEEL
VALVES, FITTINGS & FLANGES

FOR

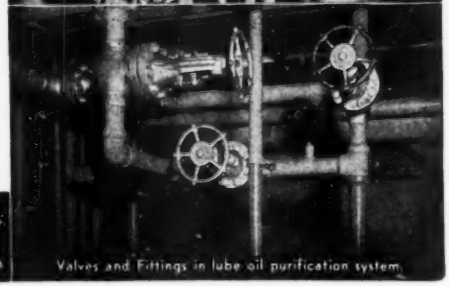
STEAM GENERATING PLANTS





1"—400lb lines in a leading generating station.

1½"—1500lb high pressure drip lines.



Valves and Fittings in lube oil purification system.

SAFE and SURE control of vapors and liquids at high pressures and high temperatures in modern steam generating plants is dependent on piping materials having an inherent "plus" of strength and toughness. *Drop forged steel* Valves, Fittings, and Flanges made by Vogt play a vital part in the smooth, efficient operations of leading power plants.

Catalog F-8 is the drop forged steel Valves and Fittings Blue Book.

HENRY VOGT MACHINE CO., INC.
LOUISVILLE 10, KY.
Branch Offices: New York • Philadelphia • Cleveland • Chicago • Dallas

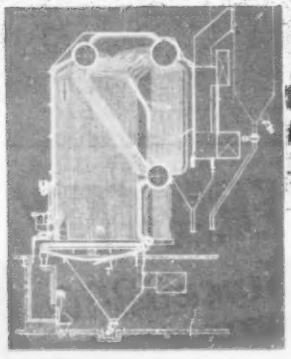
See DETROIT ROTOGRATE STOKER

Detroit RotoGrate Stokers applied to three-drum steam generators, total capacity 250,000 pounds steam per hour at Michigan State College.

The selection of Detroit RotoGrate Stokers for Michigan State's New Power Plant is typical of the trend of the times. It is only one of several Michigan institutions for which Detroit RotoGrate Stokers have been selected in a current modernization program.

RotoGrates have established a reputation during the past ten years for producing high efficiency with a wide range of fuels.

WRITE for Bulletin



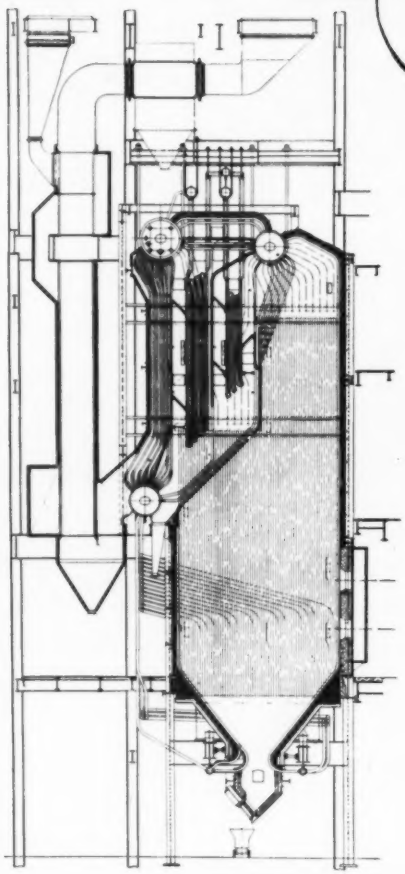
New Modern Power Plant—Michigan State College, East Lansing, Mich.
Claud R. Erickson, Cons. Engr., Lansing, Mich.

DETROIT STOKER COMPANY

Sales Offices and Engineering Department:
Fifth Floor, General Motors Bldg., Detroit 2, Mich.
Works at Monroe, Mich.—District Offices in Principal Cities

Other TYPES and SIZES of DETROIT STOKERS for Every Industrial or Power Need

350,000
POUNDS OF STEAM PER HOUR



Purchaser—
Minnesota Power & Light Co.

Location—
Duluth, Minn.

Number of Boilers 1

Type of Boiler
Erie City 3-Drum
Steam Generator

Pounds of Steam/Hr. 350,000

Design Pressure....1025 PSI

Operating Pressure . 925 PSI

Steam Temperature.. 905° F.

Water Walls.....Erie City
Bare Tube

Air Heater.....Erie City
Tubular

STEAM POWER PLANT EQUIPMENT

Complete Steam Generators • Type C 3-Drum Boilers • Type VL 2-Drum Boilers • The "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • Coal Pulverizers • Underfeed Stokers • Welded Pressure Vessels for the Process Industries.

ERIE CITY
SINCE 1840

ERIE CITY IRON WORKS • ERIE, PA.

SANTOBRITE effective, low-cost SLIME AND ALGAE CONTROL

To eliminate sluggishness and obstructions caused by slime and algae in cooling systems, use Santobrite*— Monsanto's Sodium Pentachlorophenate, Technical. An inexpensive, effective algaecide, Santobrite is recommended for use wherever water is not used for drinking or bathing.

The Santobrite treatment requires no special equipment of any kind . . . Merely add to circulating water at any convenient location. Results are equally satisfactory whether used in large industrial installations or smaller systems.

To learn how Santobrite can help you maintain peak efficiency in cooling operations, send for a copy of Monsanto Technical Bulletin O-15. Address MONSANTO CHEMICAL COMPANY, Desk A, Organic Chemicals Division, 1763 South Second Street, St. Louis 4, Missouri.

SANTOSITE*

controls oxygen corrosion in boiler systems

By removing all traces of residual oxygen, Santosite* (Monsanto's Sodium Sulfite, Technical) prevents oxygen corrosion in boiler tubes and other steam generating equipment. For complete information on this simple, economical control, send for a copy of Monsanto Technical Bulletin O-26. *Reg. U. S. Pat. Off.

MONSANTO
CHEMICALS for PLASTICS

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
Desk A, 1763 South Second Street, St. Louis 4, Missouri

Please send me ( ) Technical Bulletin O-15, on Santobrite; ( ) Technical Bulletin O-26 on Santosite.

Name _____ Title _____

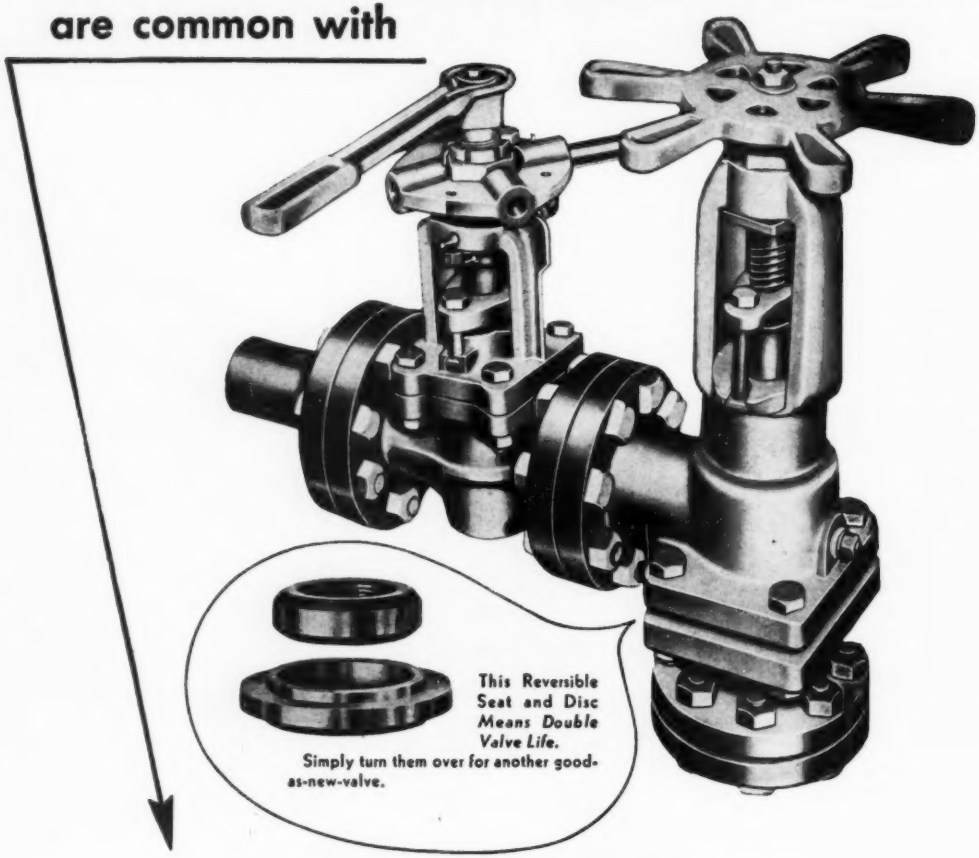
Company _____

Address _____

City _____ State _____

SERVING INDUSTRY . . . WHICH SERVES MANKIND

. . . records of 30 years continuous service are common with



HOVALCO-HOMESTEAD
BOILER BLOW-OFF VALVES

- THEY'RE *BUILT TO OUTLAST THE BOILER*
- AND THEY COST *30% TO 60% LESS TO MAINTAIN.*

Double the life span of ordinary valves is assured when you use Hovalco-Homestead Boiler Blow-Off Valves because built into each valve is a special, *reversible,* long-wearing, S Monel seat and disc which is actually an "extra" set of accurately ground, perfectly matched seating surfaces ready to be put into service whenever the need arises. By simply unbolting the lower valve body and turning over the seat and disc, you have a good-as-new valve ready for another long lifetime of service.

In combination with Homestead **Lever-Seald** or Cam-Seald Quarter-Turn Valves, they meet A.S.M.E. requirements and all state laws for boiler blow-off service.

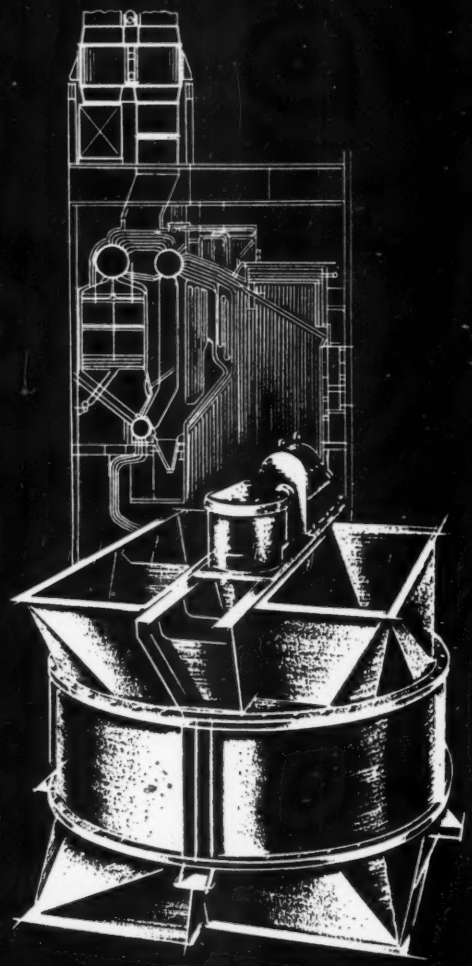
We can furnish them in sizes 1½", 2" and 2½" for pressures to 600 pounds. Detailed information and a copy of Valve Reference Book No. 38 are yours for the asking. Write us.

HOMESTEAD VALVE MFG. CO.

P. O. BOX 210 CORAOPOLIS, PA.

Designed for Preheat

when high-temperature air is essential



With the Ljungstrom Air Preheater, it is possible to supply high-temperature preheated air for combustion or processes.

While plans for steam generation plants are under consideration investigate the possibilities of the Ljungstrom. The specialized experience of Air Preheater engineers is at your disposal, to aid you in effecting the most economic heat recovery from flue gases.

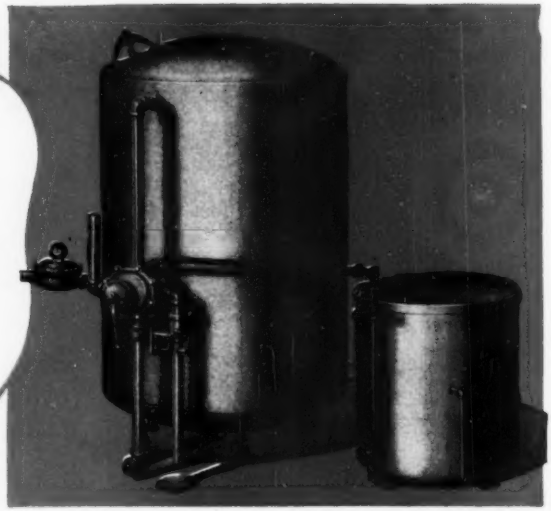
The Air Preheater Corporation

EXECUTIVE OFFICES: 60 East 42nd Street, New York 17, N. Y. • PLANT: Wellsville, N. Y.

21,000 EXTRA GALLONS

of soft water per regeneration!

That's what this ELGIN WATER SOFTENER gives you!

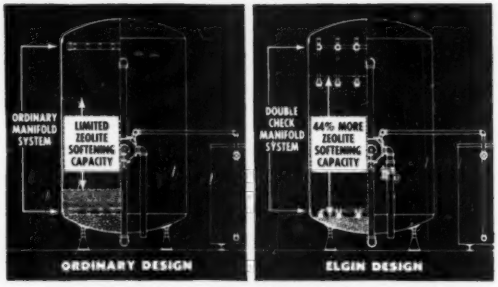


There's no secret about it! The drawings show the big improvement in the Elgin Water Softener that does the trick . . . gives you up to 44% more soft water . . . for example, 21,000 more gallons per regeneration from a 42" x 72" softener handling ten-grain water than is delivered by the ordinary water softener.

This basic improvement is the Elgin "Double-Check" arrangement. It's one of those why-didn't-someone-think-of-it-before ideas—a manifold arrangement which prevents the escape of zeolite under all operating conditions. By so doing it permits a far deeper bed of zeolite in a softener of given size, and of course more zeolite means more soft water output. Also, by preventing zeolite loss, a higher backwash rate is made possible. This cleans and opens up the zeolite bed thoroughly —means better and quicker regeneration with less salt consumption.

There's no question about it! The story of extra gallons of soft water is being told in daily service by Elgin "Double-Check" installations in more than 3000 plants. Their ability to save dollars in first cost, in operating cost, in maintenance cost is indelibly written into the records of plants like yours.

And note this: Existing softeners, regardless of make, can be modernized by Elgin to incorporate the features and advantages of this "Double-Check" design.



SAME SIZE UNIT—SAME TYPE ZEOLITE

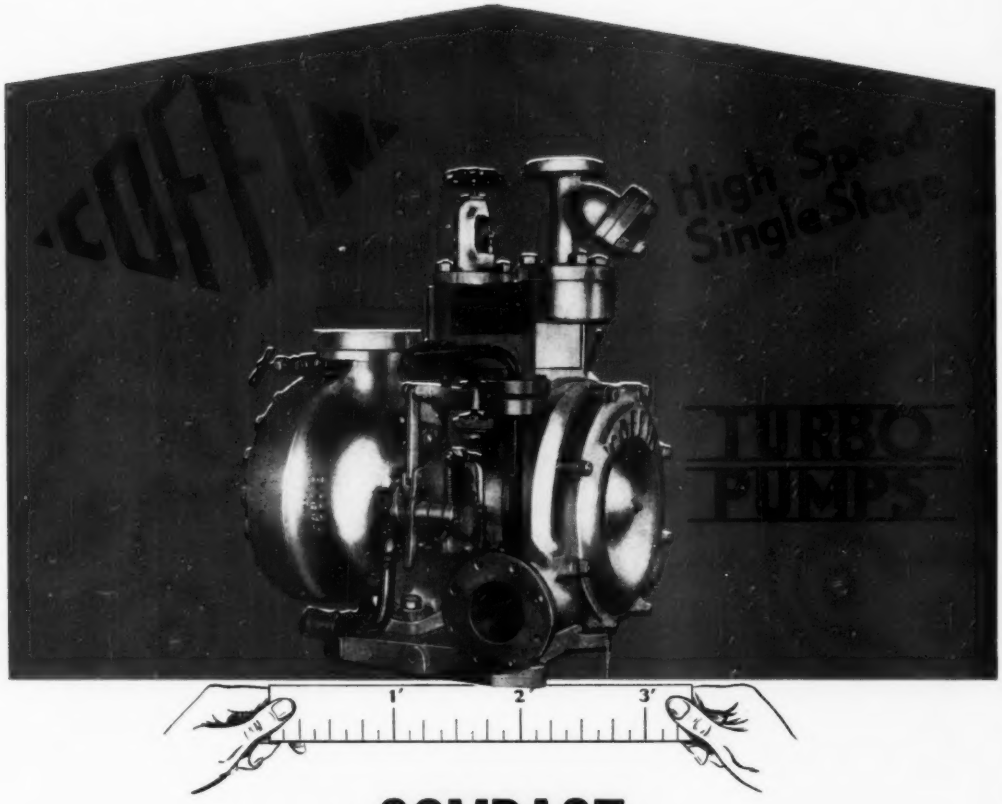
Whatever your water conditioning problem Elgin has the answer—While the Elgin "Double-Check" Softener represents the zeolite water softener at its best, it is not the answer to every water conditioning problem. Such is the scope of Elgin equipment and methods, however, that we are in a position to give you an unprejudiced recommendation covering your particular needs. One of our district engineers would like to show you how we can solve your problem. No obligation whatever.

Ask for this new bulletin—It describes the design and advantages of this revolutionary water softener.

ELGIN SOFTENER CORPORATION

330 N. GROVE AVE., ELGIN, ILLINOIS

SOFTENERS ★ FILTERS ★ WATER TREATMENT ★ BOILER WATER CONDITIONING



A COMPACT High-Capacity Pump

with MATCHED Pump, Turbine, and Governor, *all in one* unit!

Only Coffin can give you a complete single-stage 7200 rpm turbo pump that delivers the equivalent of a 3- to 6-stage pump operating at 3600 rpm. Backed by years of research and engineering design, Coffin Pumps are standard equipment wherever a high-speed, high-capacity, space-saving pump is required.

Capable of handling liquids up to 300°F, Coffin Pumps are used throughout industry on boiler-feed applications, high-pressure boiler-feed booster and desuperheating service, as well as drip and high-pressure condensate pumping problems, to mention only a few outstanding instances. Each unit is individually engineered and assembled from standardized interchangeable parts. Maintenance costs are low and 10,000-hour continuous service periods between inspections are usual. Write for Bulletin "S".

Specifications

Steam Pressures....to 650 PSI.
Steam Temperatures..to 850 F.
Back Pressures.....to 60 PSI.
Pump Capacities...to 500 GPM
Discharge Pressures to 750 PSI. (Heads to 1800 ft.)
Liquid Temperatures..to 300 F

See our catalog in Sweet's Power Plant and Engineering Files.

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1... PYROID

two exceptional compressed sheet packings

2... R/M No. 670

Raybestos-Manhattan manufactures many different types of sheet packing . . . in widths up to 150" . . . and in thicknesses from 1/64" to 1/8". Each of these compressed sheets is of long-fibre asbestos, scientifically compounded to meet the exacting requirements of industry.

R/M No. 650, nationally known as "Pyroid," is shown above. It is recommended for applications where severe service conditions are encountered; for public utility service where excessively high pressures and temperatures are met. It can be used, however, for practically any condition, and makes an economical sheet packing even in cold water service.

Where first cost is an important consideration, many plants rely on R/M No. 670, also shown above. This sheet has a low rubber content and is approved by the National Board of Fire Underwriters for use in connection with such hazardous liquids as benzol, gasoline, and kerosene.

Whatever your requirements, see your authorized R/M distributor for the sheet packings best suited to your needs.

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R M

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WITH the addition of the new Full Modulating Weatherstat for either hot water or steam heating plants, Honeywell now offers a complete line of outdoor control systems. All the features of other types of Weatherstat control are included in the new modulating system, plus the advantage of a continuous flow of heat modulated to furnish just the amount needed. Orifices provide for accurate balance within the building or zone.

Second of Honeywell's outdoor systems is Weatherstat Two-Position Zone Control which is used for applications with two or more zones or buildings supplied with district steam. Weatherstat Direct Control, the third System, is designed for small commercial buildings, apartment houses and similar structures which do not require zoning.

Remember, only Weatherstat control takes into account all four factors affecting heat losses—outside temperature, wind velocity, wind direction and solar radiation. With a Weatherstat system, overheating on sunny days and underheating on windy days is eliminated. Building temperatures are economically maintained at an even level during all outside weather conditions. Get the facts now about all three Weatherstat systems. Write Minneapolis-Honeywell, Minneapolis 8, Minnesota. In Canada: Toronto 17, Ontario.

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COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Looking Ahead for 1949

Increased Power Production—Wider Use of the More Corrosion-Resisting Alloys

According to a national power magazine, central power stations (mainly private, but including all government plants) will probably add about 22,000,000 kilowatts through 1952. It is predicted that by 1957 the total installed capacity will reach 90,000,000 kilowatts, an increase of approximately 73 per cent over present installed capacity of 52 million kilowatts. An extensive modernization and expansion program is also anticipated for industrial power plants, with the trend toward more electric power services per worker, per machine and per square foot of factory space.

Among the notably growing loads are air conditioning, water heaters, home freezers, more electrical appliances, television, expanding rural electrification, more powerful machine tools, high frequency process heating, electric welding and many more. Such new developments as the heat pump, reported in the December Bulletin, while hardly a factor now, indicate the kind of new uses which are expected to swell the demand.

Anticipate More Severe Conditions

Millions of pounds of condenser and heat exchanger tubing will be needed for new equipment as well as for replacement to serve future years.

More corrosion-resisting tube alloys should be specified. Experience over many years of condenser operation indicates that pollution of water from sewage is increasing because of growing population centers. More industrial, chemical and processing plants are discharging corrosive waste products into rivers and harbors. It has also been shown that as water traffic increases, more sediment is stirred up and finds its way into the condenser tubes.

Another factor is more severe operating conditions. Equipment is running on a more continuous basis, with little respite for the condensers and other units using condenser and heat exchanger tubing. There is a constant drive for greater efficiency.

More Corrosion-Resistant Alloys Are Being Used

A study of recent condenser tube installations indicates a definite trend toward the use of more corrosion-resistant alloys, such as Aluminum Bronze and Aluminum Brass, especially by seaboard power plants. With many of the inland power stations located along rivers, water conditions are also serious because of pollution by industrial wastes and sewage. Arsenical Admiralty and Aluminum Brass are being specified although Muntz metal had been satisfactory when the water was still clean.

It seems logical that only the best available alloys should be specified in order to obtain satisfactory performance during the years to come.

Laboratory and Service Tests Most Valuable

Which alloy will best serve for certain specific conditions of operation? Fortunately, a great deal has been accomplished by corrosion research during the past few years. In the laboratory and in the field more knowledge is being gained about the behavior of condenser tube alloys in various waters under a wide range of operating conditions. Bridgeport continues to maintain active research in this field, and is also constantly correlating the information gathered from working with hundreds of power plant operators.

It is most desirable to combine such information with careful tests carried out at the location involved. Some power plant engineers, in anticipation of the time when they will have to retube their condensers, install sample lots of various alloys for observation. Best results are obtained when such tests are conducted on a scientific basis and the results evaluated by personnel experienced in corrosion. Valuable information is also obtained from careful records kept by power plant engineers regarding water and steam compositions, velocities and temperatures, operating procedures, etc. Since some field and service tests may require years, plans must be made well in advance of the time when tubing is to be ordered.

Conserving Heat

With the constant drive to increase the production of electrical energy from existing equipment and available fuel, more importance is placed on auxiliary heat exchanger equipment. Since tubing is the heart of feed water heaters, evaporators, boiler blow-down heat exchangers, generator coolers, economizers, etc., operators are paying special attention to selection of tube alloys which will give the longest service.

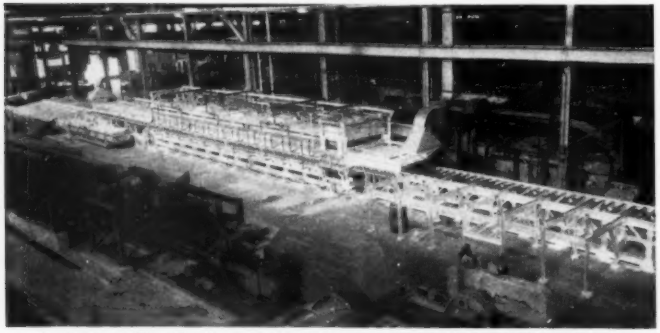
Place Orders Early

After a condenser tube alloy has been selected, the next consideration is getting delivery on time. It may not be practical to wait until the last minute to order condenser and heat exchanger tubing. Tubing should be ordered well in advance of the time when it will be used. Condenser tubes are precision products which must be made with care and tested thoroughly before they are released for shipment. With new installations, some purchasers find it convenient to place condenser tube orders at the same time they place specifications for condenser and heat exchanger equipment.

Progress at Bridgeport and Indianapolis

During the past year, steps have been taken to further increase production facilities at our Bridgeport, Connecticut, and Indianapolis plants. Laboratory corrosion research continues active.

Contact the nearest Bridgeport office regarding your tubing problems and our laboratory service. Much valuable information is published in Bridgeport's 120-page Condenser Tube Manual. Have you a copy?



100,000-Pound Draw Bench and Controlled-Atmosphere Furnace in Tube Mill at Bridgeport.

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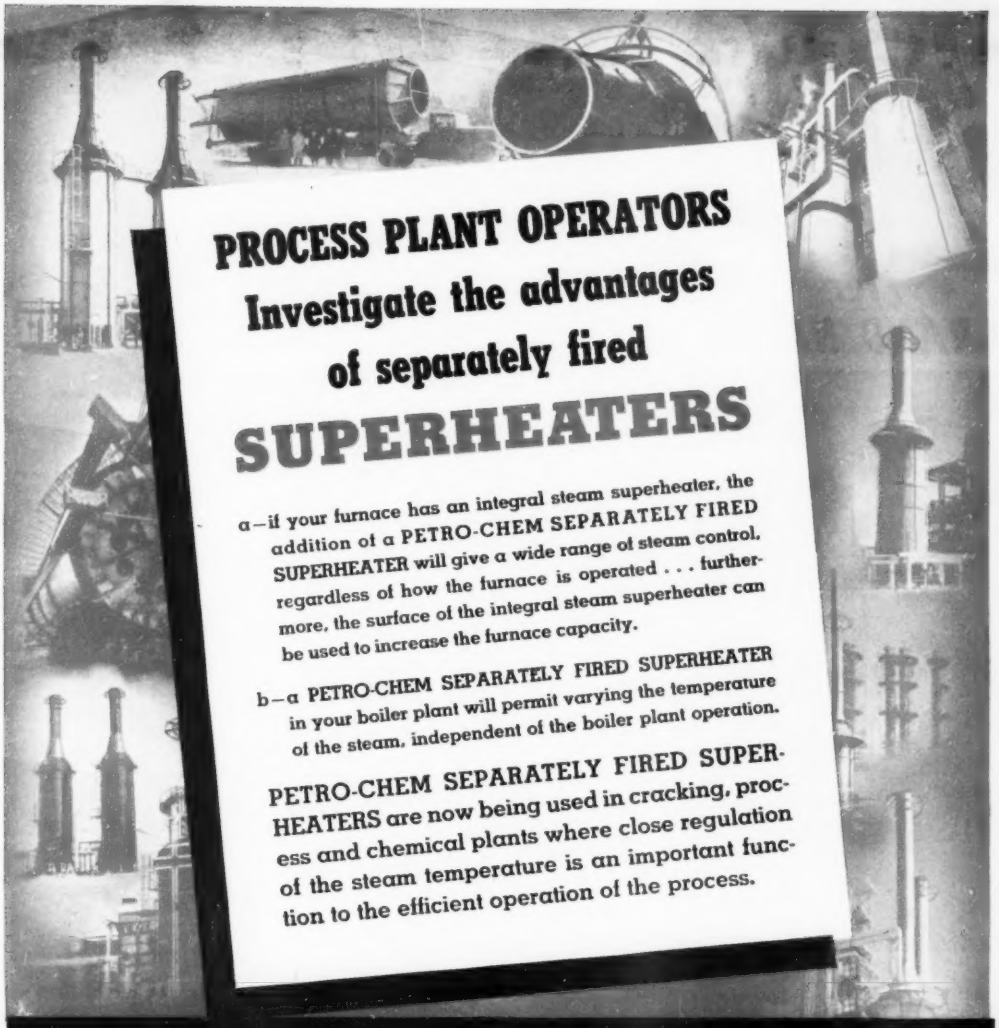
Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal



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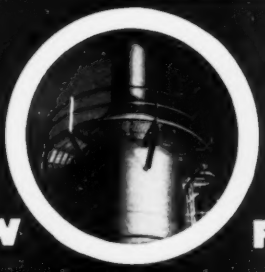
Investigate the advantages of separately fired
SUPERHEATERS

a—if your furnace has an integral steam superheater, the addition of a PETRO-CHEM SEPARATELY FIRED SUPERHEATER will give a wide range of steam control, regardless of how the furnace is operated . . . furthermore, the surface of the integral steam superheater can be used to increase the furnace capacity.

b—a PETRO-CHEM SEPARATELY FIRED SUPERHEATER in your boiler plant will permit varying the temperature of the steam, independent of the boiler plant operation.

PETRO-CHEM SEPARATELY FIRED SUPERHEATERS are now being used in cracking, process and chemical plants where close regulation of the steam temperature is an important function to the efficient operation of the process.



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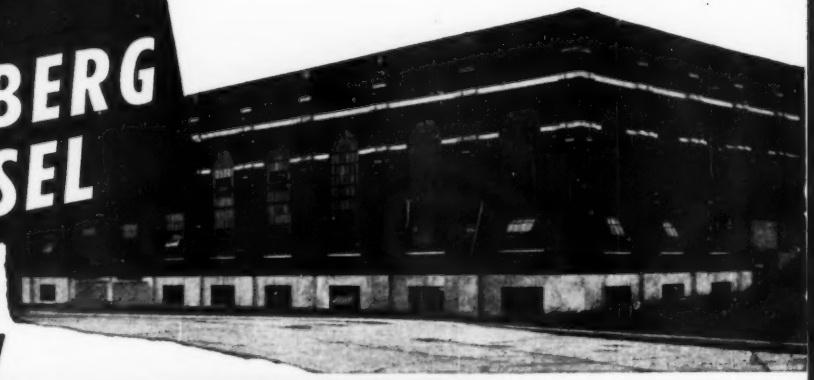
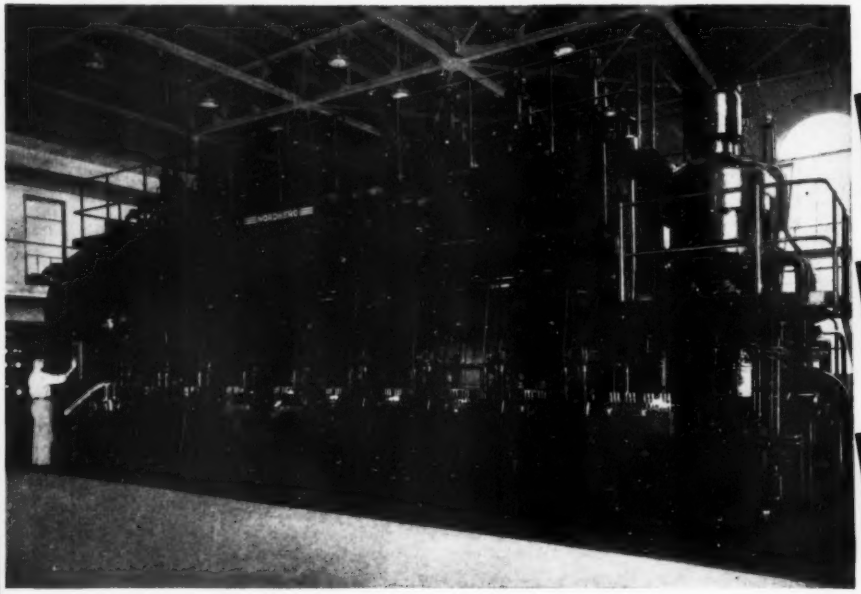
3rd NORDBERG DIESEL for GRAND HAVEN





1937 . . . ADDITION TO THE EXISTING POWER PLANT MADE, AND INSTALLATION OF FIRST NORDBERG DIESEL, A 2250 HORSE-POWER UNIT.

1941 . . . INSTALLED THEIR SECOND NORDBERG DIESEL—A 3850 HORSEPOWER UNIT.

1948 . . . THE THIRD NORDBERG DIESEL INSTALLED—ANOTHER 3850 HORSEPOWER UNIT, LOCATED IN A NEW POWER PLANT ADDITION. (ENGINE AND BUILDING ILLUSTRATED.)

THE story of power plant progress in keeping up to ever-increasing electric demand in Grand Haven, Michigan, is typical of many similar municipalities. Starting over fifty years ago with a modest steam engine plant, Grand Haven has progressed through turbines, smaller 4-cycle engines, and ultimately to the use of large, sturdy Nordberg 2-cycle Diesels as their main power supply. Their recent selection of a third Nordberg unit provides further proof of the proven dependability of these popular engines.

It is interesting to note that the established economy of Nordberg Diesels is further enhanced in the Grand Haven plant through their ability to operate efficiently on a heavy, straight-run residual fuel oil usually ranging from 500 to 1000 S.S.U. at 100° F. This fuel is readily obtained locally.

This is just one example of the varied power problems being solved better, more economically with Nordberg Diesels . . . in a wide range of sizes from 10 to 8500 H.P.

NORDBERG MFG. CO., MILWAUKEE 7, WIS.

GEARCHI-SYNCRO
A DIVISION OF NORDBERG

NORDBERG
DIESEL ENGINES

How to take ups and downs with less friction

CARRYING 250 tons of coal per hour at a belt speed of 312 feet per minute on a 249 foot decline, this 1,485 foot-long conveyor is typical of the many heavy duty installations for which Robins Conveyors uses Timken-equipped troughing idlers.

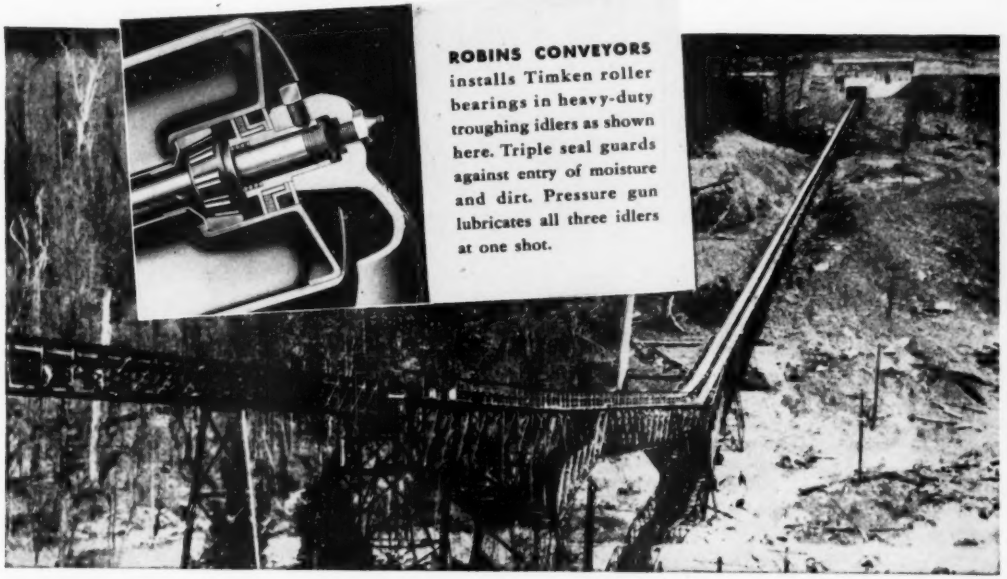
Steep ups and downs in conveyors like this mean heavy wear and tear on the belts unless the idlers run freely. With Timken bearings, idlers roll easily under the heaviest loads—allow the belt to keep moving without drag or friction and consequent chafing and fraying. What's more, this smooth, friction-less operation normally lasts the life of the conveyor, with minimum attention and maintenance expense.

Because of the line contact between the rolls and races, Timken bearings have tremendous load carrying capacity. Their tapered construction allows them to handle both thrust and radial loads in any combination. Wear is negligible. Timken design permits the use of tight closures that seal lubricant *in*—keep dirt, dust and water *out*.

No other bearing combines all the advantages of a Timken tapered roller bearing. No matter what equipment you use or make, the trade-mark "Timken" on the bearings is an assurance of long life, dependable performance and continuous trouble-free operation. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN BEARING EQUIPPED

This symbol on a product means its bearings are the best.



ROBINS CONVEYORS installs Timken roller bearings in heavy-duty troughing idlers as shown here. Triple seal guards against entry of moisture and dirt. Pressure gun lubricates all three idlers at one shot.

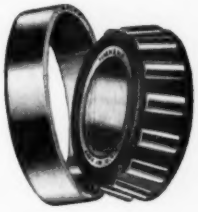
36" declining conveyor at Williams River Mine No. 1 of the Gaulley Mountain Coal Co. Speed: 312 ft. per minute. 250 tons of coal per hour.

TIMKEN BEARING CAPACITY RATINGS INCREASED 25%.

Since Timken bearings were last re-rated some 15 years ago there has been such a further and constant improvement in quality that we are now able to announce a 25% increase in radial and thrust load carrying capacity. This may make possible the use of smaller bearings with savings in bearing cost, material cost and weight. Engineers will be able to utilize the advantages of Timken bearings in more applications than in the past.

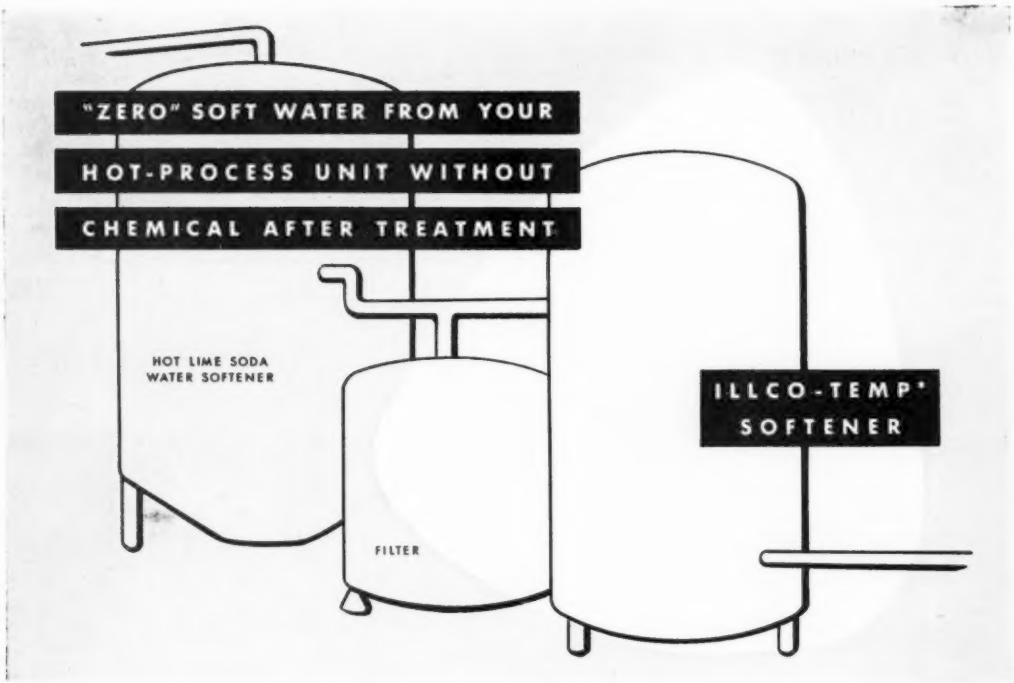
A new Timken Engineering Journal, now in preparation, will give you complete capacity rating tabulations. For further assistance, write us today.

TIMKEN
TAPERED
ROLLER BEARINGS



NOT JUST A BALL · NOT JUST A ROLLER · THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

For the First Time!



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Operates economically at temperatures up to 220°F . . . on waters having a pH as high as 10.5. Ideal unit for after-treatment of hot-process lime-soda effluent . . . to remove last traces of residual hardness. Unit is approximately same size as hot-process filter. A product of ILLCO-WAY ionXchange research.

- **provides "zero" soft water, regardless of variations in the hot-process effluent**
- **decreases the excess dosages required for straight hot-process**
- **reduces amount of chemicals required in boiler (none are needed for hardness control)**
- **eliminates frequent adjustment**
- **eliminates deposits (which result in "plugging") in valves, feed-pumps, feed-lines, heaters**
- **chemical savings alone will normally pay for equipment in less than two years**

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SOFTENING

*Process Patent Pending

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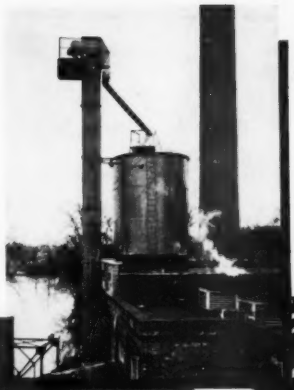
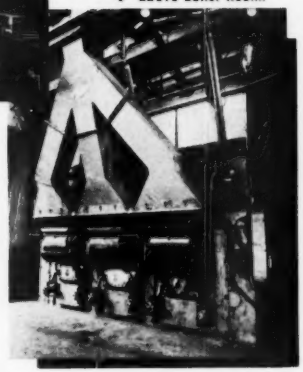
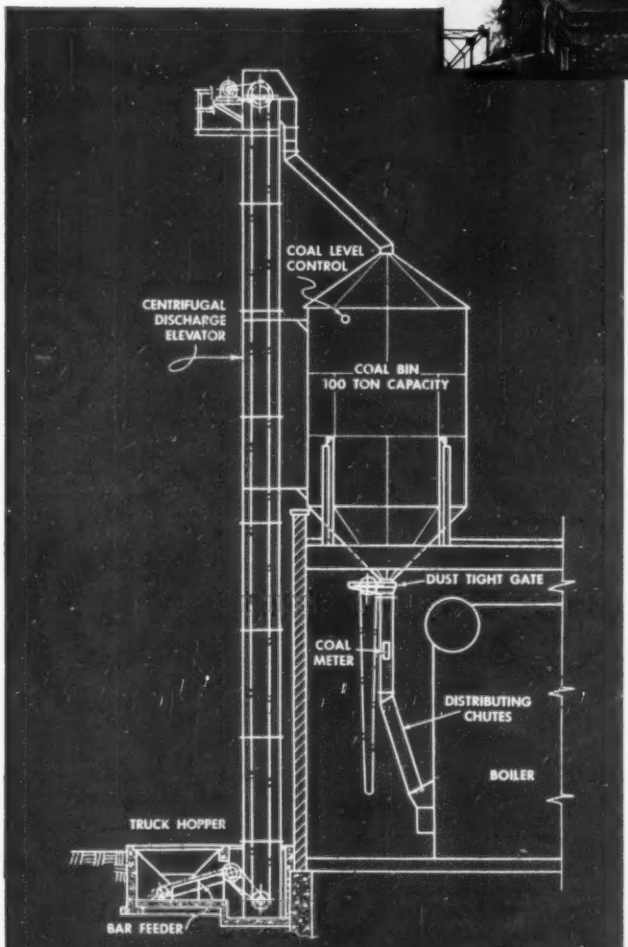
IN THIS CASE
tight quarters saved dollars



G-W Bucket Elevator and Steel Bin on Roof of Braendly Dye Works.

G-W Tri-furcated Distributing Chute Feeding Coal Directly to Stokers from Bin above Boiler Room.





When Braendly Dye Works, Inc., at Beacon, N.Y., modernized their steam boiler plant, a mechanical coal-handling system was required to replace the old, slow manual method. A G-W engineer was called in... recommended the elevator-storage system illustrated.

A river bank restricted ground storage space... a disadvantage that G-W ingenuity converted into economies. A live storage, steel bin was designed and mounted on roof directly over boiler room. Coal is supplied to bin by a bucket elevator and fed continuously by gravity directly to stokers. Warm boiler room air surrounds bottom cone of bin... prevents coal freezing.

Elevator boot is fed by bar type feeder which permits a truck hopper shallow enough to safeguard against flooding when river is high.

G-W took over *this* complete job ... from design through construction and erection...shouldered all responsibilities. G-W's complete engineering service is yours for the asking.

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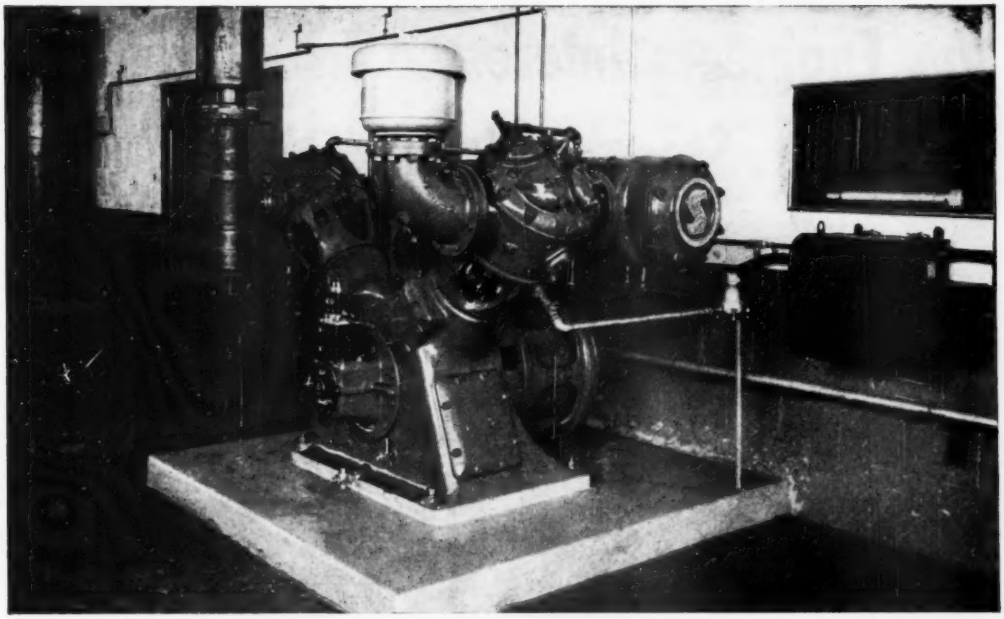

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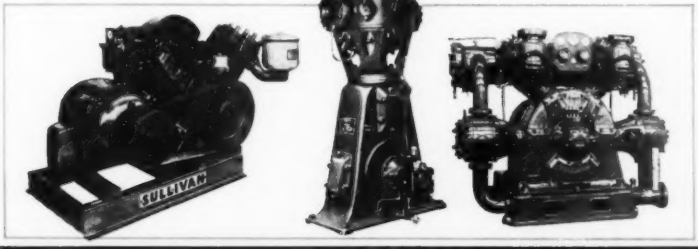
Built in sizes from 378 to 1828 CFM, the JOY WN-112 is a two-cylinder, two-stage, heavy-duty compressor with the exclusive JOY "Dual-Cushion" valves for top efficiency. Compact and highly modern, it saves space and cuts installation costs. ● JOY builds the most modern compressors available for either centralized or de-centralized air supply—*write for Bulletin.*

The JOY WL 80, in nine sizes from 81 to 590 CFM.

The JOY WG 9, in eleven sizes from 153 to 822 CFM.

The JOY WN 114, in single or twin units, 1092 to 7312 CFM.



Consult a Joy Engineer

W&D 12055

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96 Pages *of Illustrated, Diagrammatic and Tabular Matter regarding . .*

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VALVE CONTROLS

Hundreds upon hundreds of valves on land and sea — for every conceivable use, are being safely, speedily and dependably opened and closed by *LimiTorques* day in and day out.

Yes, this catalog shows different types; how they work; how they are connected; wiring diagrams; control panels; floor stands; position indicators; pictures of *LimiTorques* in action in all types of plants; views of *LimiTorques* applied to most all makes of valves, etc. — indeed, a veritable "treatise" on Motorized Valve Operation.

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- CONTROLLED GRAIN STRUCTURE OF METAL —STRESS RELIEVED
- STRENGTH WITH MINIMUM WEIGHT

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All of these advantages are yours in Globe Welding Fittings. Globe's metallurgical experience and highly specialized production and processing facilities are utilized beginning with the production of Globe seamless steel tubes and continuing through every step to the finished Globe welding fittings.

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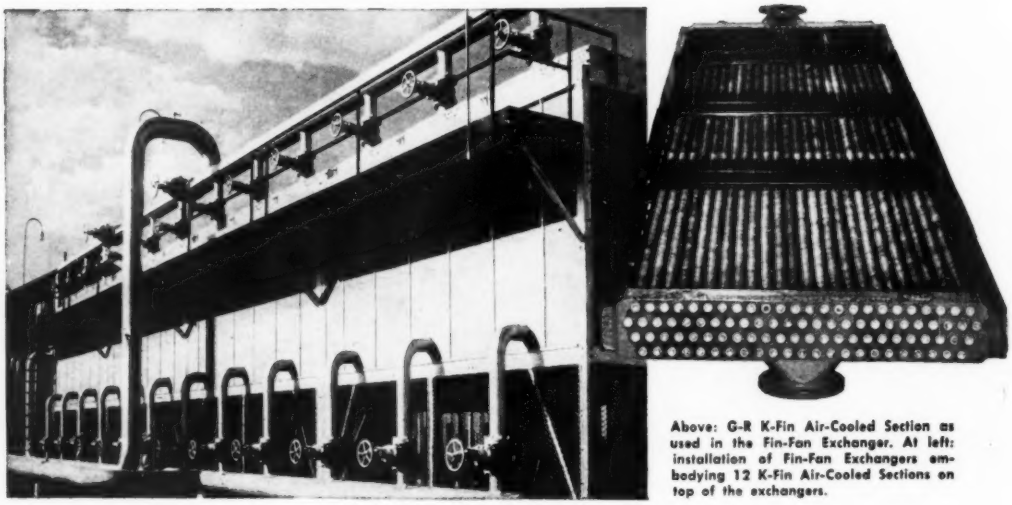
Distributors are invited to write for complete information and details

Now you can **condense steam** or **cool liquids** and **gases** by **AIR** in the **FIN-FAN EXCHANGER**



Above: G-R K-Fin Air-Cooled Section as used in the Fin-Fan Exchanger. At left: installation of Fin-Fan Exchangers embodying 12 K-Fin Air-Cooled Sections on top of the exchangers.

At last! . . . a compact, effective, dependable, all-weather *air cooled* condenser and cooler that eliminates the complications, expenses and troubles of water cooling equipment.

The "package-type" self-contained FIN-FAN Exchanger comes to you as a complete unit, ready for erection. It is strongly designed for high pressures and temperatures, can be installed in limited space within a building, on the ground, or on a roof, and it operates with *forced draft*, independent of the direction or intensity of air currents.

This advantageous unit is being used for condensing exhaust steam and refrigeration systems, and for cooling oil, water, process liquids and gases in installations all over the country. Its G-R K-Fin elements with helical fins have proven their superior effectiveness and durability in many thousands of cooling and condensing units; and its fan, fan drive and structure are expressly designed by Fluor Corporation Ltd., who are associated with The Griscom-Russell Co. in the development of these units.

Write for Bulletin 1231 describing the Fin-Fan Exchanger in detail.

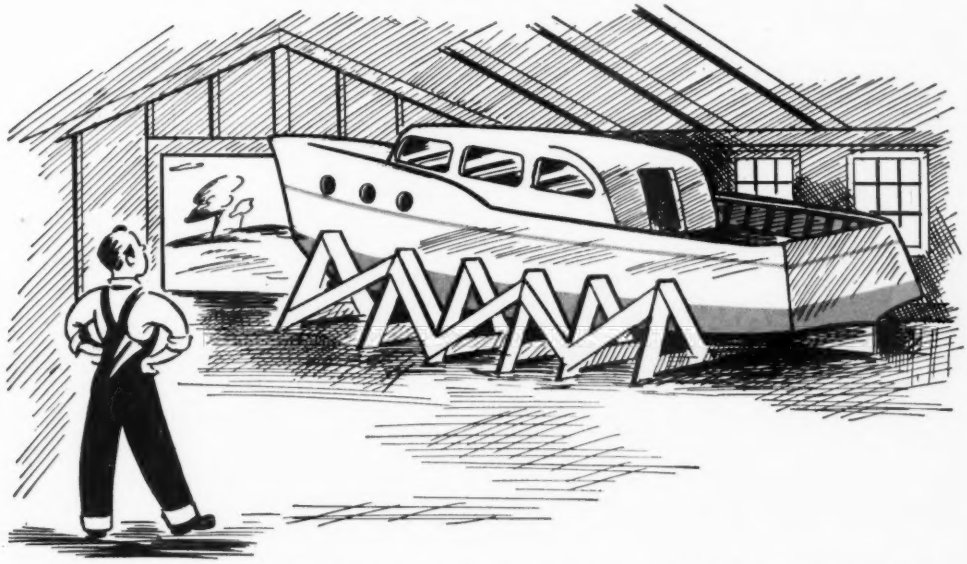
GR-210

THE GRISCOM-RUSSELL CO., 285 MADISON AVENUE, NEW YORK 17, N. Y.

GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

Power Plant Operators: Don't Copy



HE BUILT IT TOO BIG FOR THE DOOR!

• Farsighted power plant operators are conducting coal investigations before preparing design specifications for new plants, thus assuring complete fuel flexibility.

Economical steam generation is dependent not only upon reliable operation, but also upon complete freedom to purchase the best coal value available under all market conditions.

Often only minor changes to present equipment are necessary to materially widen coal selection.

The Division of Research and Fuel Engineering of the Ohio Coal Association will furnish, upon request, technical information and data which will provide guidance to power plant designers, operators and owners in their selection of equipment to save fuel dollars.

OHIO COAL ASSOCIATION

ROCKEFELLER BUILDING • CLEVELAND 13, OHIO

Today's GENERAL HIGH COST TREND SUGGESTS ATTENTION TO YOUR Boiler Room

GET IMMEDIATE AND PERMANENT RESULTS WITH

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

AS A SOURCE OF IMPORTANT SAVINGS

Today cost pressure keeps demanding new ways to save money. You can get at the root of this situation in your boiler room.

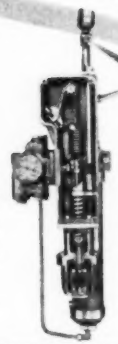
Whether you have one or a battery of boilers you'll find your boiler room can deliver good savings through Correct Fuel Feed — Fuel-Air Ratio, and Over-Fire Draft.

You accomplish this with CASH STANDARD Automatic Combustion Control Systems. What you actually get is more steam from your present boiler—less fuel, coal-oil-gas used—savings in maintenance. CASH STANDARD units are available in a number of variations. Combinations can be made to give you complete automatic control with all of its benefits. Size of your boiler or type make no difference.

Send for

BULLETIN 300

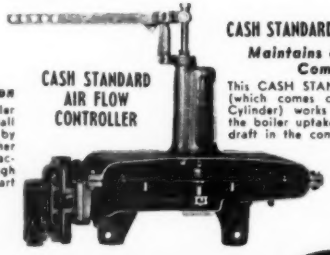
It shows applications—tells how the system works—gives you a good insight into the savings possible.



CASH STANDARD FUEL FEED CONTROLLER . . .

Automatically Regulates Fuel Feed

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.



CASH STANDARD AIR FLOW CONTROLLER

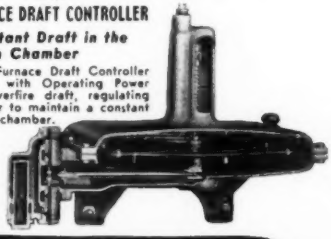
Meters the Air Needed for Combustion

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

CASH STANDARD FURNACE DRAFT CONTROLLER

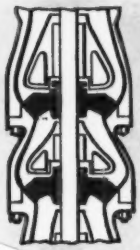
Maintains a Constant Draft in the Combustion Chamber

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.

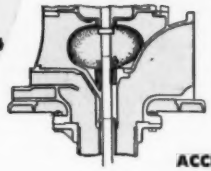


A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS . . VALVES



OPEN IMPELLERS
. . . that eliminate overloading, sand-locking and costly stoppages
. . . minimize wear
. . . eliminate the need for sealing or wearing rings.

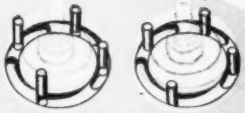


ACCESSIBLE PACKING BOX
. . . located at the surface where it is easily inspected, tightened or repacked.

You Get More than Performance with POMONA!

Almost any good pump will give you performance . . . *at the start.* But Pomona Vertical Turbine Pumps give you *sustained* performance . . . consistent efficiency for years *plus* the fundamental simplicity of design that adds up to lowest operating and maintenance costs. Here's why!

ADJUSTABLE FOR CAPACITY AND WEAR. With a simple "at the surface" adjustment, capacity can be varied over a wide range without throttling. Adjustment can also be used to compensate for wear to retain peak efficiency for life.



NON-REVERSE RATCHET . . . prevents pump and motor from rotating backwards
. . . eliminates possible damage to pump from accidental power reversal
. . . reduces wear and maintenance.

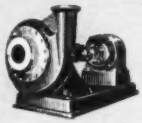
PLUS *true* water lubrication and many other important advantages your Fairbanks-Morse Pomona dealer or branch pump engineer will be glad to demonstrate. Fairbanks, Morse & Co., Chicago 5, Ill.

FAIRBANKS-MORSE

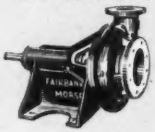
A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS • GENERATORS
STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS

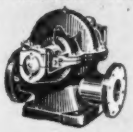
A FEW OF THE COMPLETE LINE OF FAIRBANKS-MORSE PUMPS



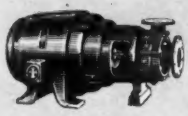
Trash Pumps



Side-Suction

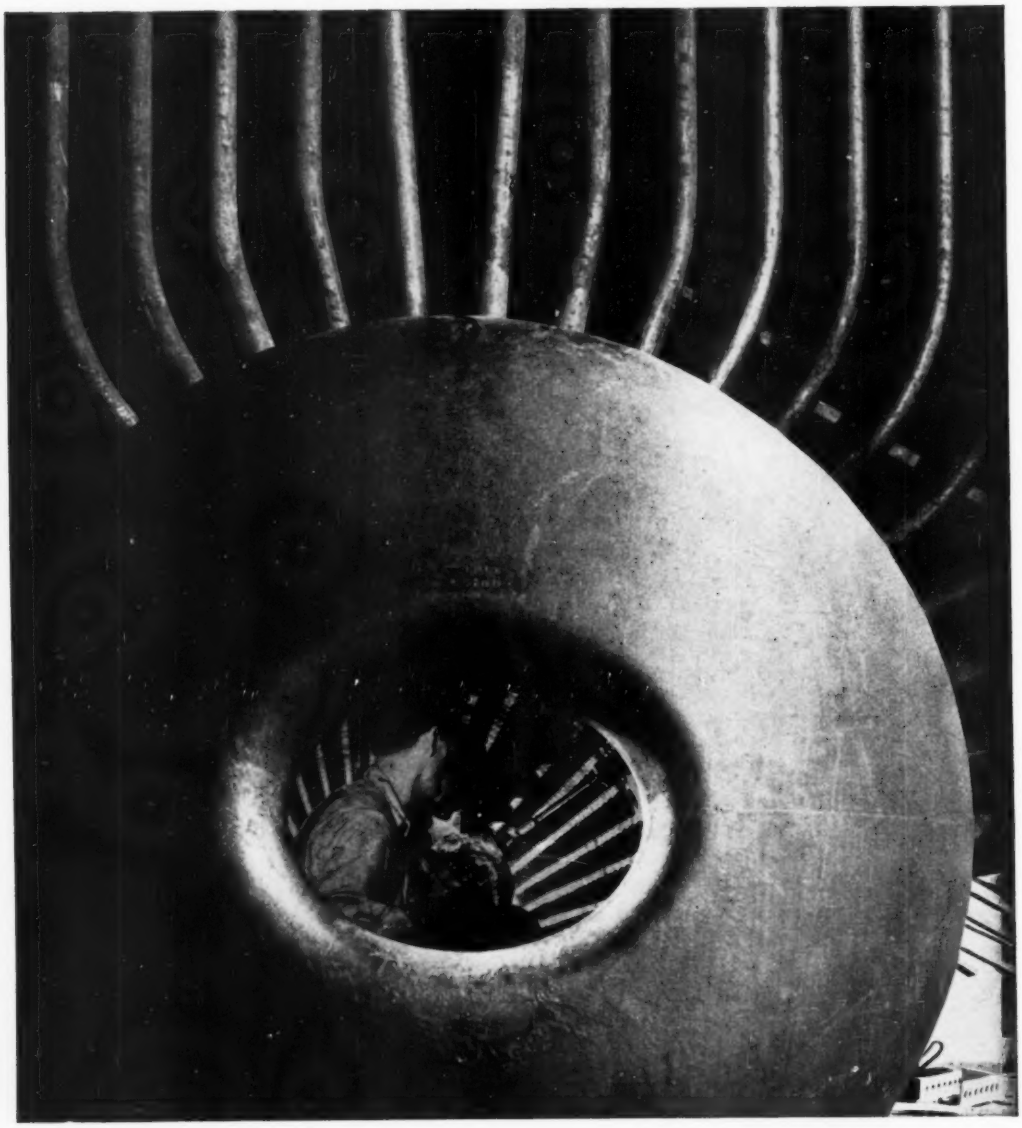


Centrifugals



Builtogether

AGAIN *in*



Cleveland it's ELECTRUNITE

. . . IN THREE NEW STEAM GENERATING UNITS FOR THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

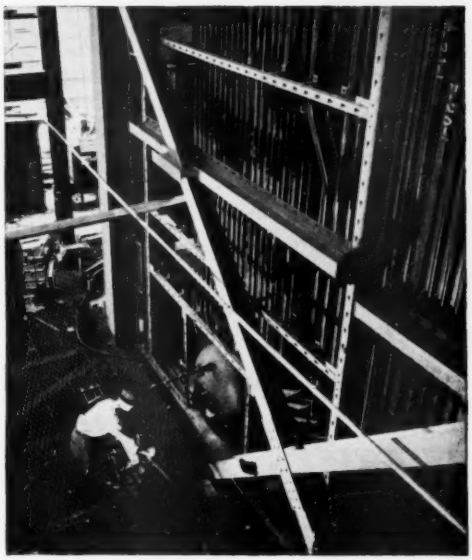
● Long one of the nation's foremost light and power companies, The Cleveland Electric Illuminating Company has played an important part in Cleveland's industrial growth—is nationally known for its promotion of *"Cleveland—The Best Location in the Nation."*

Included in a $93,000,000 current construction and improvement program is the rebuilding of one of two steam generating plants which provide heat for downtown Cleveland office buildings. Three new 150,000 pound per hour boilers—tubed with ELECTRUNITE—are replacing 11 small stoker-fired boilers, some of which have been in service for more than 45 years.

That Republic ELECTRUNITE Boiler Tubes are being used exclusively in the new boilers, is a strong indication of the safe, dependable service which these *modern* boiler tubes provide. Republic's improved process of electric resistance welding makes each tube tough and strong, yet highly ductile throughout its entire length . . . with soundness assured by rigid hydrostatic testing and a thorough inspection.

For complete information about the many cost-saving advantages of Republic ELECTRUNITE Boiler Tubes, write to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York



Hydrostatic pressure test being conducted on one of the three new Combustion Engineering Boilers installed in The Cleveland Electric Illuminating Co's. Canal Road steam heating plant. Each of the new units is tubed throughout with Republic ELECTRUNITE Boiler Tubes.

Republic ELECTRUNITE
Reg. U. S. Pat. Off
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

REPUBLIC STEEL

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.

Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.

Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.

Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

On-Time Delivery made possible by a flexible planning group authorized to re-route work to meet promised dates.

This fellow starts where the shop leaves off!

THIS welder is on a job site—in a power house far from Kellogg's plant. He's only one of a crew installing power piping which Kellogg prefabricated. But what he and his partners do, away from the critical eyes of the plant metallurgists and technicians, will go a long way toward determining whether the new piping being welded into position stands up to its "built-in" performance possibilities.

Faulty metal formations can on occasion flow from the end of any welding rod . . . locked-up stresses can be established through carelessly controlled heat treating practices . . . even the fitters, who install the temporary supports before welding can cause damaging stresses in this piping that came through plant inspection with flying colors.

Only experience and knowledge of "what not to do" and expert supervision can preserve the basic qualities built into that piping at the plant. And that should be reason enough for purchasers to consider carefully the relative efficiency and quality of installation forces *before placing orders for critical power piping.* For in essence these installation crews establish final performance of installed piping.

The high repute in which Kellogg installation work is held is the result of more than thirty years of daily association with power piping of all types.

It is the result of knowing where and how to apply positive checks of quality!

It is the result of building over the years a force of supervisory personnel capable of assimilating the pertinent metallurgical information uncovered with each additional day's experience.

It is the result of manning each job with trained, tested and experienced piping engineers, welding inspectors, and stress relieving technicians.

It is all of these plus a management approach which demands that Kellogg piping *in the power line* retain every performance property built into it *at the fabricating plant.*

FABRICATED PRODUCTS DIVISION

THE M. W. KELLOGG COMPANY

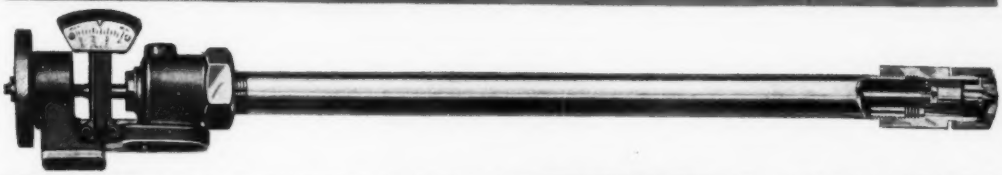
A SUBSIDIARY OF PULLMAN INC.

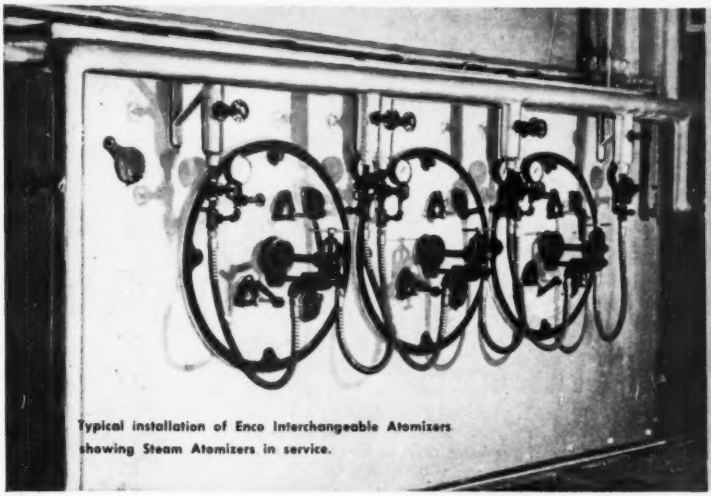
NEW YORK • JERSEY CITY • BUFFALO • LOS ANGELES
TULSA • HOUSTON • TORONTO • LONDON • PARIS

VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING
PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

It takes 5 ordinary atomizers to match the performance of the

ENCO WIDE RANGE Mechanical Atomizer





Typical installation of Enco Interchangeable Atomizers showing Steam Atomizers in service.

A complete line of gas and liquid fuel burners are designed and built by ENCO to meet the wide range of capacity requirements of steam plants, refineries, kilns and industrial process furnaces. Two of these are:

ENCO Steam Atomizing Oil Burner

ENCO Standard Mechanical Atomizing Oil Burner

All types of ENCO Atomizers are interchangeable quickly and easily.

Designed to minimize operating troubles in either full load or ignition service, the Enco wide range mechanical atomizer will handle a capacity of 10 to 1 . . . without changing burner tips when using 300 psi oil pressure. This equals the performance of *five* ordinary atomizers.

Now used in many power plants throughout the country, the Enco wide range mechanical atomizer maintains a more constant velocity of oil through the atomizer, and utilizes the high oil pressure to insure efficient atomization over the entire load range. Large or small boilers can be brought on the line and carried up to full load operation without changing sprayer plates.

The Enco wide range mechanical atomizer can be controlled manually by a simple twist of the hand-wheel or automatically by a remote control or combustion control system. It is built to give most economical, efficient service for any type of pulverized coal, gas, or oil-burning register as well as for stoker-fired and industrial type furnaces.

• WRITE TODAY FOR FULL INFORMATION

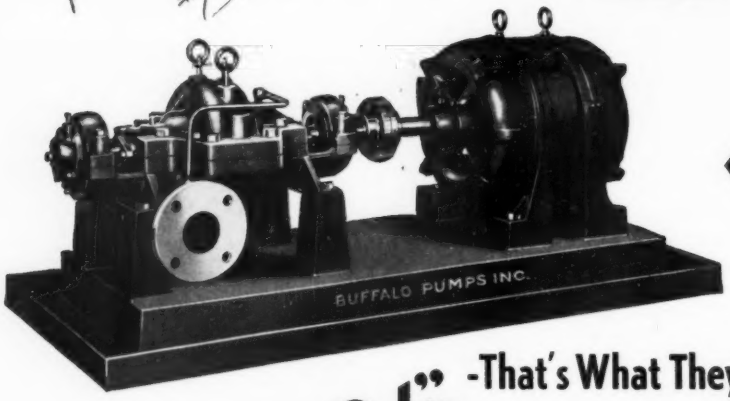
RC-477

THE ENGINEER COMPANY

75 WEST STREET, NEW YORK 6, NEW YORK

IN CANADA: P. I. RAMSAY, LTD., 4220 SHERVILLE ST., MONTREAL 34, P. Q.

Smoothest Running Pumps We've Ever Used!



LOOK INTO THIS EFFICIENCY AND ENDURANCE for your clear water pumping! Bulletin 680-B tells about it, with engineering data. Write for your copy—now!

"Buffalo" -That's What They're Saying About GENERAL SERVICE PUMPS

Users of "Buffalo" RR Pumps for boiler feed and other clear water service are giving us just about this same report — these sturdy, smooth-running pumps are operating at efficiencies of 75% *and better* — many of them have been doing it for *ten years without a single major part replacement!* It's this efficiency and this freedom from trouble that saves you money from the moment a "Buffalo" RR Pump starts working for you.

We'd like you to see what goes into the making of these pumps, to get results like this—the extra deep stuffing boxes, the rugged, high-efficiency impellers, the extra large bearings, shafts and impellers. Write for Bulletin 680-B.

PUMPS BY "Buffalo"

BUFFALO PUMPS, INC.

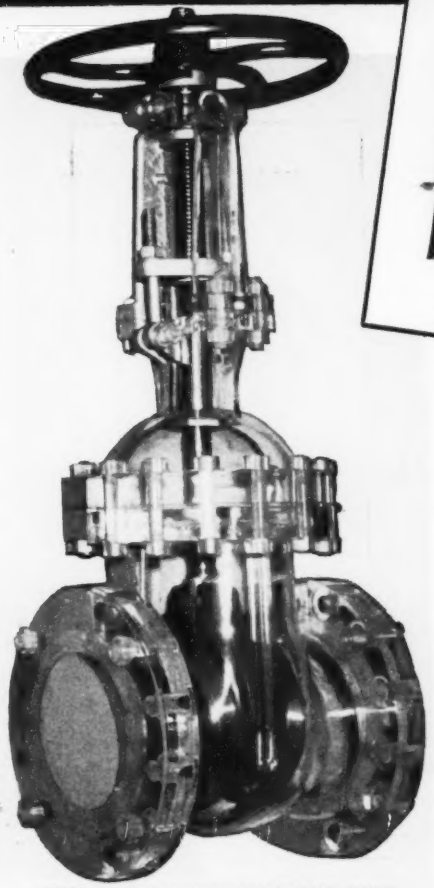
488 BROADWAY BUFFALO, N. Y.
CANADA PUMPS LTD., KITCHENER, ONT.
Branch Offices in All Principal Cities

"A Better CENTRIFUGAL PUMP for Every Service"

THE *Inside Story* OF

OIC

PACE-SETTER IN VALVES



OIC'S FAMOUS PLASTIC TRANSPARENT VALVE has traveled the country from one exhibition to another showing plant engineers everywhere the exclusive advantages of the long OIC line of superior valves. This plastic valve lets you *see* how OIC Valves work—why they operate easier and quicker . . . why OIC Valves wear less and require less maintenance. This plastic Valve lets you see why OIC *Sets the Pace in Valves!*

CAREFULLY selected trim alloys for greater utility and durability. • Extra-deep stuffing box for a more efficient, longer lasting seal. • Long condensing chamber beneath stuffing box to protect the packing from excessive heat. • Precisely calculated flange dimensions, bolting requirements, and gaskets for a superior construction at these critical points. • End-seated type seat rings for a positive, leak-proof closure. • Straight-through ports to minimize turbulence and maintain peak pressure. • Sturdy I-beam wedge is guided by integrally-cast body ribs interlocked with long machined slots on each side of the wedge. This feature insures true alignment and reduces vibration during opening and closing.

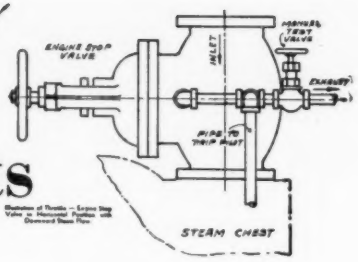
0-149-25

SEND FOR THE OIC CROSS REFERENCE CHART. You'll find that your change-over problems are gone forever. Simply check the number of the valve on the line that you wish to replace, find it in the chart, and you will find the corresponding OIC Valve for the job. Write for your chart to The Ohio Injector Company, Wadsworth, Ohio.

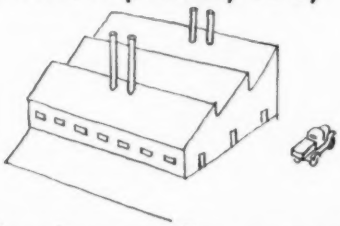
OIC VALVES

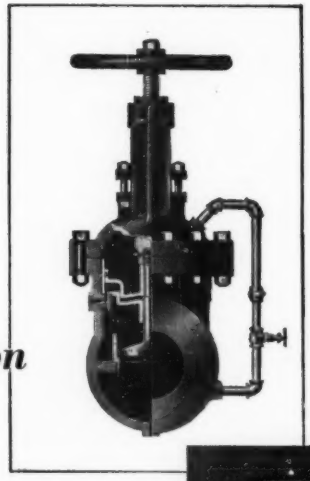
STEEL • IRON • BRONZE

Large plants

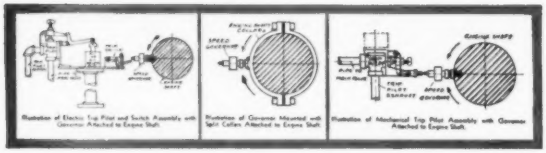


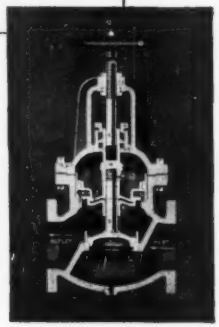
and small plants, too,





need this Engineered protection





GOLDEN-ANDERSON

Throttle

and

Automatic

engine stop

Valves

Throttle and Automatic Engine Stop Valves by Golden-Anderson have saved manufacturers many thousands of dollars in property and personnel damage from run-away engines and turbines. These valves are completely automatic, but a remote control attachment is included to permit manual operation for tests and other purposes. When handwheel stem is run up, the valve will automatically open to admit pressure into engine or turbine, thus permitting easy return to engine operation. For complete information on the more than 1500 types and sizes designed and built by Golden-Anderson, write for new catalog today.

GOLDEN-ANDERSON *Valve* **Specialty Co.,** KEENAN BUILDING, Pittsburgh 22, Pa.,

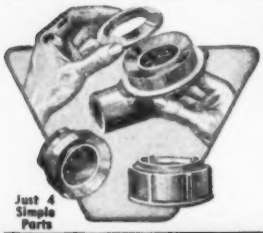
the WICKES Boiler Co.

SAGINAW, MICHIGAN

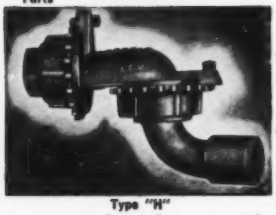
The Wickes Type "S" Standard 2-Drum Unit is designed for industrial plants and particularly where operating and maintenance forces are small. This unit has a generating capacity of 15,000 to 50,000 lbs. steam per hour. It is adaptable to any standard method of firing—oil, gas, single retort underfeed stoker, or spreader stoker, and should the fuel market change, any of the above methods of firing may be readily substituted. With the Type "S" Unit, space conditions are no problem, since the design of the furnace makes this unit a low head boiler. The depth, width and distance between drum centerlines being variable in the standard design, virtually any space situation can be met. Your boiler problems will receive our engineers' consultation and recommendation without obligation.

SALES OFFICES: Atlanta • Boston • Charlotte, N. C. • Chicago • Cincinnati • Denver • Detroit • Houston • Indianapolis • Kansas City • Los Angeles • Milwaukee • New York City • Pittsburgh • San Francisco • San Jose • Seattle • St. Louis • Tulsa • Saginaw • Mexico City • Buenos Aires.

DIVISION OF THE WICKES CORPORATION • RECOGNIZED QUALITY SINCE 1854



FLEXIBILITY *and* SAFETY with FLEXO JOINTS



Type "H"

Flexo Joints combine the flexibility of hose with the strength of pipe for conveying steam, air, liquids, gases or vapors—wherever a flexible joint is needed. Flexo Joints handle pressures and temperatures up to superheated steam with unrestricted flow. Made in four styles—each assembled from four interchangeable parts—each style for standard pipe sizes from ¼" to 3". Movement through 360° in either direction. Flexo Joints are designed for long wear—no springs—no small parts—maintenance cost is negligible.

Write for full details

FLEXO SUPPLY CO., Inc.
4655 Page Blvd. St. Louis 13, Mo.
In Canada: S. A. Armstrong, Ltd., 115 Dupont Street, Toronto 5, Ontario

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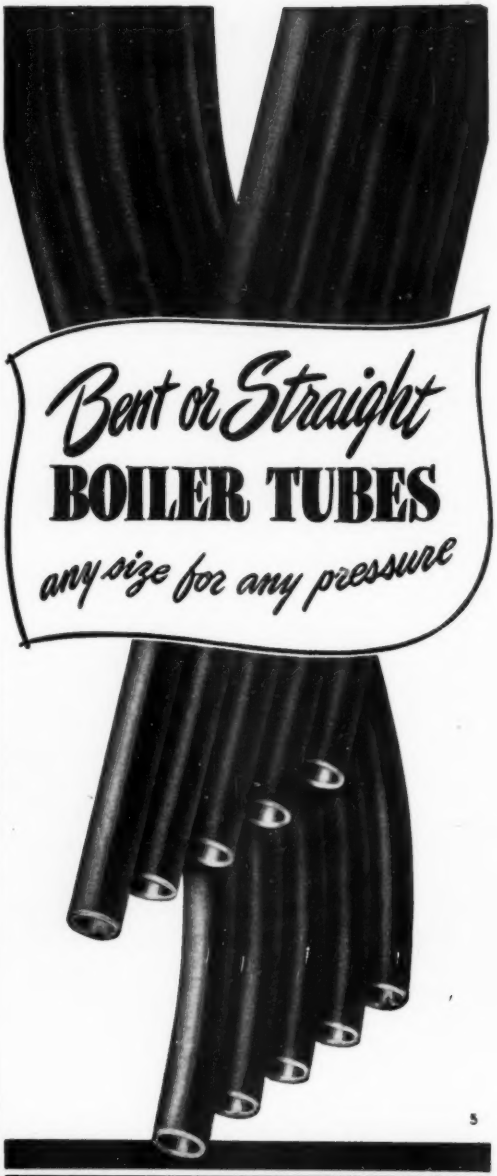

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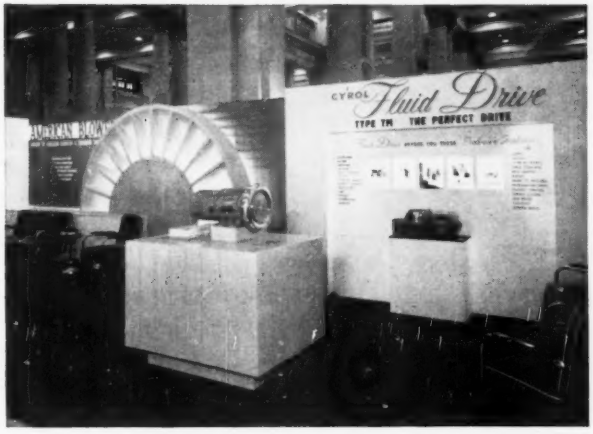

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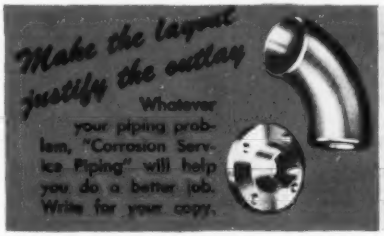
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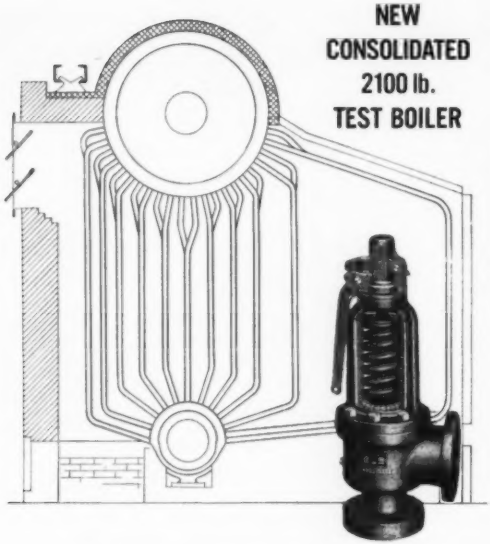

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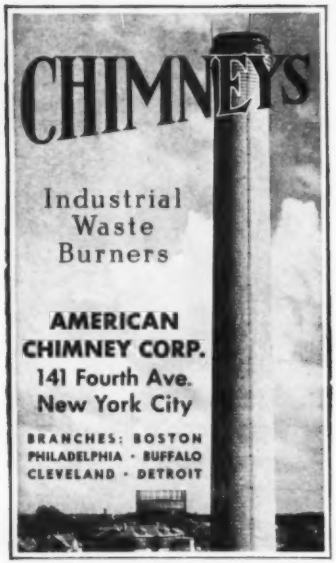

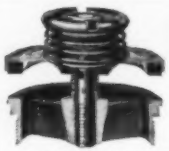

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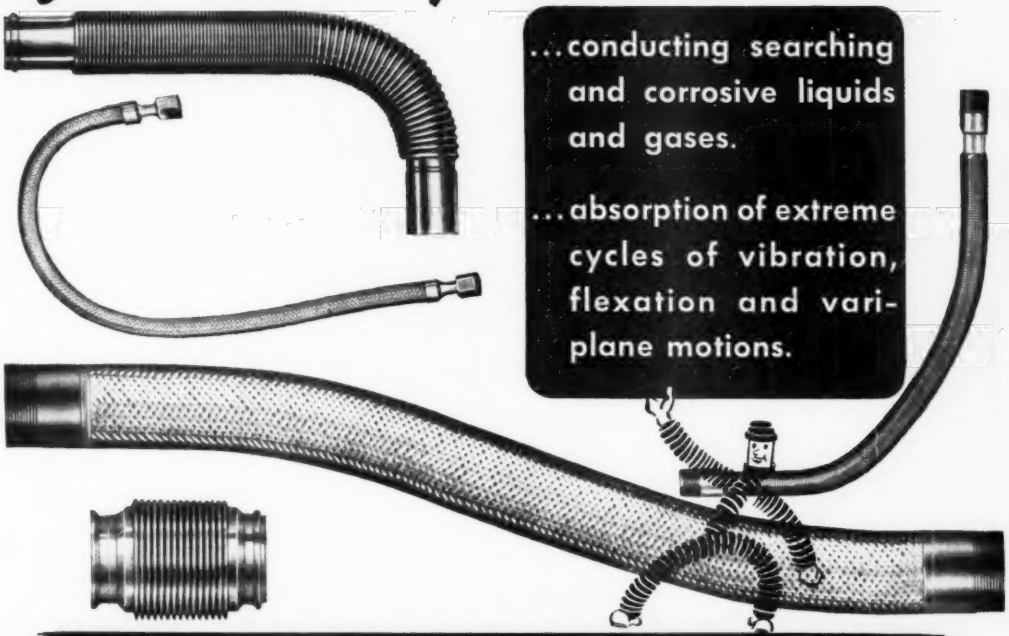

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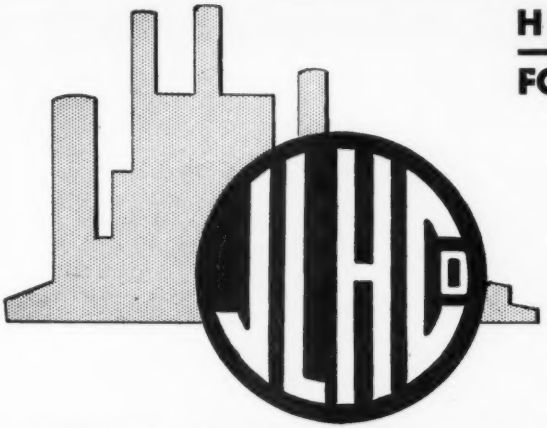

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3—300 KVA, G.E., type H, 2300 V Pri., 115/230 V Sec.
300 KVA, Pitts., 7800-440 v.
205 KVA, Whse., 2 phase, 2300 to 3 ph., 4150 autp.
200 KVA, 4000 v.—110/220.
100 KVA, Pitts., 1375/2750 v.—110/220.
3—100 KVA, Wagners, 240/120 v.—120 v.
2—100 KVA, Newark, 440 v., 3 phase to 220 v., 2 phase.
2—100 KVA, Whse., 13,800 v. to 250 v.
3— 75 KVA, G.E., 2400 v.—120/240.
4— 50 KVA, Whse., 2400 v.—120/240.
4— 50 KVA, Whse., 13,800 v. to 125 v. or 250 v.
4— 50 KVA, Whse., 6900 v. to 125 v. or 250 v.

A. C. GENERATORS

2500 KVA, Whse., Syn. Cond., 720 RPM, 2400 v.
500 KW, .8 P.F., 3600 RPM, ATB, 600 v.
320 KW, Allis, 450 RPM, 480 v.
240 KW, G.E., ATB, 600 RPM, 600 v.
200 KVA, Allis, 3600 RPM, 240 volt.
200 KVA, Whse., 600 RPM, 240 v.
180 KW, Whse., 514 RPM, 550 v.
165 KW, El. Mach., 514 RPM, 240 V.
100 KW, G.E. ATB, 600 RPM, 240 v.
75 KW, Whse., 900 RPM, 220 v.
62½ KW, Allis, 3600 RPM, 220 v.
7— 50 KVA, Whse., 900 RPM, 220 v.
3— 35 KWA, Columbia, 1200 RPM, 240 v.
1— 31.3 KVA, America, 1200 RPM, 120/208.
15 KW, Star, 1800 RPM, 220/440.
12.5 KVA, Whse., 1200 RPM, 240 v.

TURBINE BLOWERS

1—Spencer Turbine Blower, 1000 cubic feet, 30 oz. pressure with a 15 H.P., 3600 RPM, General Electric Type FT, 200 volt motor.
1—Bellmore, 550 cubic feet, 7 inch vacuum, with a 20 H.P. 3600 RPM, General Electric, Type K, 220 volt 3 phase motor.

MOTORS, 3 Phase, 60 Cycles
SQUIRREL CAGE

750 H.P., General Electric, 750 RPM, 6600 v., 25 cycle.
450 H.P., Ridgeway, 900 RPM, 2200 volts.
125 H.P., G.E., KF, 1750 RPM, 2200 v.
125—H.P., U.S., 1200 RPM, Vert., 220 volts.
150 H.P., G.E., KT, 1200 RPM, Vert., 220 volts.
100 H.P., G.E., 400 RPM, 440 volt.
75 H.P., West., CS, 1750 RPM, 440 volts.
60 H.P., Whse., 900 RPM, Vert., 2200 volts.
60 H.P., Whse., 900 RPM, 440 volts.
2— 40 H.P., G.E., 900 RPM, 220 volts.
35 H.P., Whse., 1200 RPM, CS, 2200 volts.

MOTORS, 3 Phase, 60 Cycles
SLIP RING

2500 H.P., G.E., 257 RPM, 6600 volts.
450 H.P., G.E., 425 RPM, ITC, 440 volts, 25 cycle.
2— 150 H.P., G.E., 1M, 440 volt, 450 RPM.
100 H.P., G.E., 1M, 440 volt, 25 cycle, 720 RPM.
75 H.P., Whse., CW, 720 RPM, 440 volt.
75 H.P., G.E., MT, 1200 RPM, Vert.
50 H.P., G.E., MT, 600 RPM, 220 volt.
2— 50 H.P., Whse., CW, 900 RPM, 220 volts.
40 H.P., Cont., 1200 RPM, JA85, 220 volt.
40 H.P., G.E., 1200 RPM, MT, 220 volt.
40 H.P., G.E., 900 RPM, 220 Volt, ITC.
40 H.P., G.E., 900 RPM, MT, 900 RPM, 220 volt.
40 H.P., G.E., 900 RPM, 2200 volt.

AIR COMPRESSORS

312 CFM, 100 lb. Ingersoll Rand, model 75, with motor.

LARGE STOCK OF D.C. MOTORS AND GENERATORS

SYNCHRONOUS MOTORS

4—200/100 H.P., Whse., 720/360 RPM, 4150 v.
200 H.P., Whse., 600 RPM, 240 v.
1—200 H.P., G.E., 257 RPM, 440 volt.
1—150 H.P., G.E., 1800 RPM, 220 v., TS.
75 H.P., G.E., 1200 RPM, 440 v.
70 H.P., Elect. Mach., 180 RPM, 2200 v.
40 H.P., Whse., 1800 RPM, 220 v.
35 H.P., G.E., 1200 RPM, 2200 v.
20 H.P., Whse., 1800 RPM, 220 v.

MOTOR GEN. SETS

1—1000 KW, G.E., 600 volts—4150—514 rpm. Syn.
1— 400 KW., G.E., 230 V. 900 RPM, 2300 V. Syn.
1— 500 KW., G.E., 575 V. 900 RPM, 2300 V. Syn.
125 KW, CW, 125 v., 1200 RPM, 2300 v. sq. cage.
100 KW, El. Mach., 125 v., 1200 RPM, 4150 v. syn.
100 KW, G.E., 230 v., 900 RPM, 4150 v. Syn.
2— 75 KW., G.E., 125 v., 1200 RPM, 220/440 v.
6— 75 KW, G.E., 60 v., 1200 RPM, 220/440 v.
50 KW, Ridgeway, 550 v., 1200 RPM, 220 v.
25 KW G.E., ATI, 1800 RPM, 40 HP, 1800 RPM, 240 v.

PLATING M. G. SETS

250 amp. G.E., 5/6 volt, 220 v.
500 Amp., Hansen Van Winkle, 24 volt, 220/440 v.
2500 Amp., Chandeysson, 6/12 v., 400 RPM, Syn., 440 v.
3000 Amp., Chandeysson, 6/12, 400 RPM, syn., 440 v.

ENGINE GEN. SETS

150 KVA, G.E., Ames Uniflow, 200 v., 3 ph., non-cond.
2— 5 KW., Gasoline, Hobart, 1800 RPM, 120 v., 1 ph. cond. engines.
1—200/275 H.P., Gasoline Engine, Van Blerck, 8 cylinder, 1500/900 rpm.

TURBO. GEN. SETS

625 KVA, Westinghouse, 2400 v., 3 phase, non-cond.
300 KW, G.E., ATB, 240 v., 3 ph., cond.
60 KW, Whse., 120 v., D.C., cond.
30 KW, Allis, 120 v., D.C., Terry non-cond.

STEAM TURBINES

500 HP., G.E., 3 stage, 165#, 3240 RPM.
800 HP., Terry Tandem type, 720 RPM, red. gear.

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

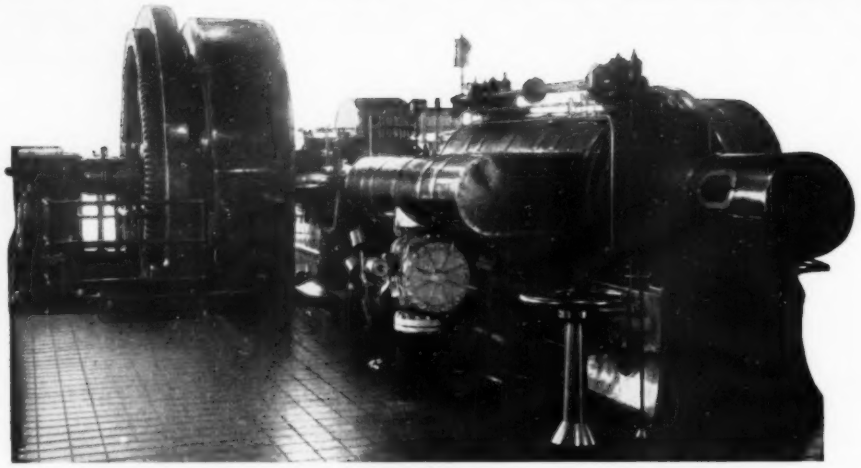
J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

POWER PLANT MACHINERY



Actual Photograph

500 KVA SKINNER UNIVERSAL UNIFLOW ENGINE GENERATOR UNIT

400 KW 80% P.F. 500 KVA General Electric alternating current generator, 3 phase, 60 cycle, 460/230 volts, 150 RPM, direct connected to Skinner Universal uniflow engine, 130-160# steam pressure, 0-5# back pressure. Complete with switchboard and auxiliaries. Excellent condition, can be shown in operation.

CONDENSING TURBO UNITS

3 phase 60 cycle

6000 KVA Westg., 2300 volts, 250# Steam
3125 KVA Westg., 2300 volts, 175/400# steam
2500 KVA G.E., 2300 volts, 225# steam
1250 KVA Westg., 2400 volts, 450# steam
1250 KVA (2) G.E., 2400 volts, 200/400# steam
750 KVA (2) Kerr, 480 volts, 150# steam, 5# extraction
625 KVA (2) G.E., 2300 volts, 160# steam
375 KVA (2) G.E., 450 volts, 400# steam

NONCONDENSING TURBO UNITS

3 phase 60 cycle

5000 KVA G.E., 13800 volts, 600# steam, 135# extraction, 25# exhaust
2500 KVA West., 2300 volts, 250# steam, 25# exhaust
1250 KVA West., 2300 volts, 300# steam, 10# exhaust
937 KVA Allis, 4000 volts, 250# steam, 15# exhaust
625 KVA G.E., 240 volts, 175# steam, 5# exhaust

UNIFLOW UNITS

3 phase 60 cycle

1125 KVA Nordberg, 480 volts, 160# steam, 5# exhaust
750 KVA Skinner, 460 volts, 150# steam, 5# exhaust
625 KVA Nordberg, 2300 volts, 160# steam, 5# exhaust
500 KVA Skinner, 450 volts, 130-160# steam, 0-5# exhaust
312 KVA Skinner, 480 volts, 115-140# steam, 0-5# exhaust
250 KVA (2) Skinner, 450 volts, 110-175# steam, 0-5# exhaust
200 KVA Skinner, 240 volts, 125-140# steam, 0-5# exhaust

SYNCHRONOUS MOTORS

6—3500 HP G. E. totally enclosed synchronous motos, 3 phase, 60 cycle, 1700 volts, 257 RPM. Equipped with surface air coolers and couplings. New 1943. These motors can be reconnected for 440 volts or rewound for 2300 or 4000 volts.

DIESEL UNITS

3 phase 60 cycle

1500 KVA (2) Nordberg, 2400 volts
1000 KVA Busch-Sulzer, 2400 volts
900 KVA Fairbanks-Morse, 2300 volts
500 KVA Fairbanks-Morse, 2400 volts
187 KVA (3) Buckeye, 240 volts
94 KVA (3) Caterpillar, 220 volts

MOTOR GENERATOR SET

60 KW General Electric interpole direct current generator 110 volts, direct connected to 85 HP General Electric induction motor, 3 phase 60 cycle, 440 volts, 1765 RPM. New 1943.

PACKAGE TYPE BOILERS

4—60,000 steam per hour Foster-Wheeler steel-encased boilers, two drum, bent tube, 435# pressure, 750 deg. total temperature, with water walls, superheaters, economizers, and Todd oil burners. New 1943.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 CLEVELAND 14, OHIO

BELYEA SAYS: "BUY FROM THE OWNER AND GET A BETTER BUY"

RE-NU-BILT EQUIPMENT

Rebuilt in accordance with N. I. S. A. STANDARDS

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	D.C. Speed	D.C. Volts	A.C. Volts
1	1800	G.E.	600	125/250	4000
1	1500	G.E.	600	600	2300/4150
1	1500	G.E.	360	275	2200/4400
1	1250	G.E.	600	275	2300
1	1000	West.	514	250	4150
1	1000	Al. Ch.	720	450	2300
1	1000	Whse.	514	600	4150
2	800	G.E.	720	600	2300/4150
1	500	G.E.	720	125	2300/4000
2	400	G.E.	720	250	440/2300
1	350	G.E.	900	125	50
1	300	G.E.	1200	250	440
2	250	G.E.	1200	250	440
1	175	Cr. Wh.	1200	250	440
1	150	Cr. Wh.	1200	250	440
1	100	G.E.	1170	125	220
1	90	G.E.	1800	60	220/440
1	75	Cr. Wh.	1160	250	220/440
1	75	G.E.	1180	125	2300/4000
1	60	Cr. Wh.	1750	250	220/440
1	60	Whse.	1150	60	220/440
1	50	G.E.	1145	125	220
2	50	G.E.	1200	250	2200

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.	T8C	4150	600
1	4000	G.E.		2400/4800	900
1	3000	Whse.		4800	720
1	3000	G.E.	ATI	4800	720

ROTARY CONVERTERS

60 Cycle

KW	Make	Speed	D.C. Volts	A.C. Volts
1—2000	G.E.	514	600	2300
1—2000	G.E.	450	600	2300
1—1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 500	Whse.	900	250	2300

FREQUENCY CHANGER SETS

1—1000 KW—GE—2 unit—3 Brg. Consisting of—1400 HP—4400 V, 3 ph. 25 cy. Motor and 1000 KW—2300 V. 2 ph. 58.3 cycle gen. with exciter (Gen. can be reconnected for 800 KW 3 ph.)

1—320 KW—GE—2 Unit—3 Brg. consisting of 600 HP—440 V., 3 ph. 60 cy., 8 pf. Syn. Motor and 400 KVA, .8 pf, type AT—3 ph, 120 cy, 720 volt AC generator with direct connected exciter.

D. C. MOTORS

HP	Make	Type	Volts	Speed
6—1500	Whse.		525	600
1—1200	Whse.		600	425
1—800/1000	Whse.		450	600/720
1—700	G.E.	MCF	600	160/625
1—650	G.E.	MPC	250	115/145
1—300/400	G.E.	DYNA	250	1325/2500
1—335	Whse.	MQ	250	300/900
1—275	Whse.	QM-600-6	230	425/850
1—250	G.E.	MPC	230	400/500
1—230	Al. Ch.		230	700
1—222	Whse.	SK-153.5S	230	2975
1—80/180	G.E.	MPC	240	400/1000
1—150	G.E.	MPC	230	250/450
1—150	Cr. Wh.	CCM	230	300/1050
1—150	G.E.		600	250/750
10—150	Cr. Wh.	83H	230	890
1—150	Cr. Wh.	CMC-65H	230	1150
2—145	G.E.	CO-1832	230	625
1—125	El. Dy.	30S	230	750/1500
1—115	Cr. Wh.	JHL	230	1200
3—101	Whse.	SK	230	485/950
1—100	Rel.	1050T	230	400/1200
1—80/100	G.E.	CD-175	230	365/730
1—80	El. Dy.	30S	230	500/1500
1—80	Whse.	SK-180	230	450/1200
2—75	El. Dy.	25-SL	230	750/1750
3—60/75	Whse.	SK-200	115	300/700
8—75	Cr. Wh.	53-H	230	880
1—75	Cr. Wh.	CMC	230	1150/1760
1—60	El. Dy.	25-S	230	525/1050
2—60	Whse.	Hoist.	230	415
1—60	Whse.	SK	230	500/1000
1—60	Whse.	SK-131	230	500/1500
1—60	El. Dy.	25S	250	750/1500
2—50	G.E.	RCP-31B	230	1700
1—50	G.E.	RC-34	230	1050
1—50	G.E.	RF-16	230	500/1500
1—50	Whse.	SK-131	230	500/1500
4—50	Whse.	Hoist	230	400
1—50	Whse.	SK-153	230	690/1035
1—50	G.E.	CD-123	230	675/1035
1—50	Cr. Wh.	CMC-8014	230	380/750

2— 40 Rel. 385-T 230 400/500

These units are semi-enclosed, b. brg. motors and part of complete V-S Drive with 40 KW Ind. M.G. Set with 220/440 v. A. C. Motor; exciter and complete control equipment. M. G. and control in steel enclosure.

SPECIAL—MERCURY ARC RECTIFIERS

1—750 KW—GE—Type RdW—6 Anode 575 V., D.C. Form C with 2300 V., 60 cycle transformer and switching equipment.

Turbo Generators

See our advertisement on page 262

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	T8	2300	257
1—2100	G.E.	ATI	4600	510
2—2000	Whse.		2300	120
1—1000	Whse.		2300	189
2— 900	Al. Ch.	(New)	2200	150
1— 600	Whse.	Syn.	440	360
1— 500	G.E.	ATI	480	900
2— 500	G.E.	T8	4150	600
2— 400	G.E.	T8-9838	440	600
2— 350	G.E.	T8	2200	150
1— 325	Whse.		440	900
1— 320	G.E.	ATI	2300	900
1— 300	G.E.	ATI	440	720
1— 145	G.E.	ATI	550	720
2— 125	G.E.	ATI	440	450
1— 100	Whse.		550	600

SLIP RING

1—1000	Whse.	CW	2300		700
1— 900	G.b.	IM	2300		880
2— 700	Whse.	CW	2200		900
1— 500	G.b.	IP	550		805
3— 450	G.E.	IM	440		905
1— 400	G.E.	IM	2200		252
3— 350	Whse.	CW	2200		900
1— 350	G.E.	MT-442Y	2200	4000	253
1— 300	Al. Ch.	3 Brg.	2300		505
1— 250	G.E.	MT-563Y	550		900
1— 250	G.E.	MT-424Y	4000		257
1— 250	G.E.	MT-559S	2200		1800
1— 135	G.E.	IM	2300		700
2— 100	G.E.	IM-16	2200		435
1— 75	Whse.	CW-761	2300		1750
1— 75	F.M.	By-H16B	2300		1750
1— 60	Cr.Wh.	123-AQ	220		700
3— 50	Whse.	CI-638A	220		870
2— 50	Whse.	CIW-504	440		870
1— 50	Rel.	1XM	2300		880
1— 50	G.E.	MT-352	550		600

SQUIRREL CAGE

1— 250	G.E.	KT-539	440	1800
1— 200	G.E.	IK	550	865
1— 125	Whse.	M8	440	488
1— 125 (New)	G.E.	KF-TEFC	440	1190
1— 100	G.E.	IK-Vert.	2300	450
1— 100	G.E.	KT-543	220/440	1750
1— 75	G.E.	K	2200	1300
2— 60	G.E.	K-505	440	1170
1—60/20	Whse.	C8	220	900/450
1— 50	G.E.	KF-4038	220/440	3650
2— 50	Whse.	C8	220	870
1— 50	G.E.	KT-327	2300	1780

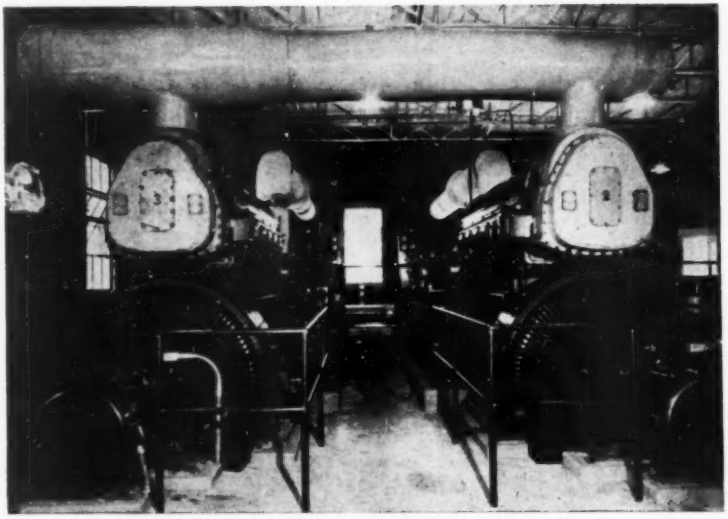
With men who know machinery **it's been BELYEA CO., INC.**

Main Office and Shop
43 HOWELL ST., JERSEY CITY 6, N. J.
Phone—Journal Square 2-3334
Also N. Y. City Line—Rector 2-7150

for 40 years

and still going strong

Another AGSCO DIESEL POWER INSTALLATION



Engineered and installed by A. G. SCHOONMAKER CO. INC., at Swans Falls, New Hampshire, these 1000KW Fairbanks Morse Diesel Engine Generating Units are in continuous, Heavy-duty service.

UNITS AVAILABLE FOR IMMEDIATE SHIPMENT

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1420	Fairbanks Morse	38D8⅛	1600	720	300	Fairbanks Morse	YVA	360	257
*1250	General Motors	16-278A	1600	720	250	General Motors	8-268A	350	1200
1250	Nelseco	6MI-53	1500	300	125	Murphy	ME-605	145	1200
1000	General Motors	12-278A	1200	720	125	Enterprise	GDB-8	150	1200
*900	General Motors	12-567	1100	720	125	General Motors	3-268A	150	1200
*625	Superior	OS	750	327	121	Fairbanks Morse	32E14	140	300
500	General Motors	6-278A	600	720	75	General Motors	6043C	90	1200
425	Baldwin	VO-6	510	450	75	Fairbanks Morse	35E8¾	90	450(BC)
375	Enterprise	DSG-6	450	450	62	Int'l Harvester	UD-18	76	1200
375	Worthington	HD-6	450	450	50	General Motors	4-71	60	1200
312	General Motors	8-268A	450	1200	18	Int'l Harvester	UD-6	22	1200

* ALSO AVAILABLE AS PORTABLE UNITS

WE OWN WHAT WE OFFER

Engineered AGSCO DIESEL POWER

A. G. SCHOONMAKER Company, Inc.

ESTABLISHED 1898

Diesel Engines • Power Machinery

52 CHURCH STREET, NEW YORK 7, N. Y. PHONE DIgby 9-4350

BEST BUYS FOR '49

"UTILITIES APPROVED"

IMMEDIATE SHIPMENT

FAIR PRICE

TURBINE-GENERATOR UNITS

3 Phase, 60 Cycle

1875 KVA G. E. condensing 250 lbs. pressure, 2300 volts, 3600 RPM complete.

1563 KVA Allis condensing 200 lbs. pressure, 600 volts, 3600 RPM complete exciter, condenser, switchboard.

1563 KVA G. E. condensing, 300 to 400 lbs. pressure, 2300 volts, 3600 RPM complete exciter, surface condenser.

1250 KVA Allis automatic extraction condensing 300 lbs., 25 lbs. bleeder pressure, 480 volts, 3600 RPM complete exciter, switchboard and condenser.

1250 KVA G. E. condensing, 250 lbs. pressure, 480/600/2300 volts, 3600 RPM complete shaft exciter, switchboard and surface condenser, panel.

1250 KVA G. E. condensing 200 lbs. pressure, 4150 volts, 3600 RPM complete exciter, condenser, panel.

1250 KVA, 480 volts, Allis-Chalmers, 150/175 lbs. pressure complete with surface condenser.

625 KVA G. E. condensing, 150-175 lbs. pressure, 480 volts, 3600 RPM complete exciter, switchboard, surface condenser.

625 KVA G. E. non-condensing, 150 lb. pressure, 15 lbs. back, 2300 volts, 3600 RPM complete exciter, panel.

375 KVA (2) G. E. condensing 400 lbs. pressure, 450 volts, each complete exciter, switchboard, surface condenser.

375 KVA G. E. condensing 125 lbs. pressure, 2300 volts, 3600 RPM complete surface condenser and panel.

125 KVA G. E. non-condensing, 175 to 200 lbs. pressure, 10 lbs. gauge back, 2300 volts, 3600 RPM complete.

100 KVA Westg. non-condensing, 125 to 150 lbs. pressure, 10 lbs. gauge back, 2400/600 volts, 3600 RPM.

TURBINE-GENERATOR UNITS

Direct Current

(2) 400 KW, 240 volts direct current Crocker-Wheeler—Worthington 440 lbs. pressure condensing steam turbine-generator units.

300 KW, 250 volts, General Electric; non-condensing turbine, 200 lbs. pressure, 40 lbs. gauge back.

200 KW (3) New General Electric 120 volts Marine type turbine generator units.

75 KW Allis Chalmers-Terry, 125 volts, 2400 RPM, 150 lbs. pressure non-condensing turbine generator unit.

60 KW (3) new Westinghouse 120 volt Marine type turbine generator units.

SYNCHRONOUS MOTORS

300 HP 80% P. F. G. E. type ATI, 2300 volts, 720 RPM synchronous motor.

900 HP Allis 3 phase, 60 cycle, 2200 volts, 150 RPM synchronous motor.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers 550/600 volts, 300 RPM direct current generator direct connected 2190 HP, 3 phase, 60 cycle 4000/6600 volts synchronous motor.

400 KW Gen. Elec. 275 volt DC, direct connected to 710 HP Gen. Elec. 3 phase, 60 cycle, 2300 volt, 720 RPM synchronous motor.

300 KW KW Allis Chalmers, 250 volt DC generator direct connected to a 430 HP Allis Chalmers 3 phase. 60 cycle, 440 volt, 1200 RPM synchronous motor.

62½ KVA G. E. 3 phase, 60 cycle, 2300 volt, 1200 RPM alternator direct connected 75 HP 125 volt DC motor.

50 KW Westg. 125 volt, 1200 RPM direct current generator direct connected 75 HP, 3 phase, 60 cycle, 2300 volt motor.

10 KW, 125 volts DC Gen. Elec. generator with 12 HP, 3 phase, 60 cycle, 220 volts, 1800 RPM motor.

DIESEL GENERATOR UNITS

Alternating Current, 3 Phase, 60 Cycle

375 KVA, 480 volt, 400 RPM Elliott-Ingersoll Rand Gas Diesel Engine Generator Units—a complete installation.

375 KVA Fairbanks-Morse, 240 volts, 300 RPM generator direct connected to 450 HP, 300 RPM, 8 cylinder, Model 32-E-14 full Diesel engine complete with switchboard.

(6) 125 KVA Westing., 450 volt, 1200 RPM, direct connected to Gen. Motors Diesel.

DIESEL GENERATOR UNITS

Direct Current

(4) 300 KW, 120/240 volts, 3-wire, 400 RPM Westinghouse direct current generators each direct connected to a 448 BHP Baldwin Diesel engine.

250 KW Crocker-Wheeler, 250 volt, 257 RPM generator direct connected to 360 HP, 6 cylinder late type Fairbanks-Morse full Diesel engine—complete.

125 KW G. E. 125 volts, 720 RPM generator direct connected 210 HP, 6 cylinder Fairbanks-Morse Diesel engine.

100 KW (6) Delco 3-wire, 250 volt generator direct connected to 150 HP, 1200 RPM, 8 cylinder Superior Diesel engine complete with switchboard.

STEAM ENGINE-GENERATOR UNITS

Direct Current

400 KW (2) G. E. 250 volts, 360 RPM generator direct connected to Skinner Unaflow vertical non-condensing engine, 150 lbs. pressure, 10 lbs. gauge back.

400 KW Crocker-Wheeler 250 volt, 150 RPM generator direct connected to a 24 x 32 Chuse, non-releasing Corliss engine. 150# pressure, 5# gauge back.

275 KW Westinghouse 250 volt, 350 RPM generator direct connected to Ames vertical Unaflow engine.

200 KW, G. E. 125 volt, 200 RPM generator direct connected Skinner Unaflow engine.

15 KW Crocker-Wheeler, 125 volts, 410 RPM generator direct connected to an American Blower vertical engine.

STEAM ENGINE-GENERATOR UNITS

Alternating Current, 3 Phase, 60 Cycle

1125 KVA G. E. 480 volts, 150 RPM generator direct connected to 28" x 36" Nordberg Unaflow engine.

625 KVA 240 volts, Gen. Elec. 150 RPM generator direct connected Skinner horizontal Unaflow engine, 125/150 lbs. pressure.

500 KVA G. E. 240 volt, 360 RPM generator direct connected Skinner vertical Unaflow non-condensing engine.

500 KVA Westg. 460 volts, 164 RPM generator direct connected to 24" x 28" Skinner Unaflow non-condensing engine, 140 to 160 lbs. pressure, 0 to 10 lbs. gauge back.

312 KVA, 220 volts, Westinghouse 200 RPM generator direct connected Harrisburg-Fleming corlis engine, 125 lbs. pressure.

156 KVA, 240 volts, 240 RPM generator direct connected to 17" x 16" Skinner Counterflow non-condensing engine 100-125# pressure.

125 KVA Westinghouse 240 volt, 257 RPM generator direct connected to Ames Unaflow engine.

DIESEL ENGINES

(10) 900 HP General Motors, Model 12-567 ATL, 12 cylinders, 744 RPM Diesel engines complete with auxiliaries. Practically new.

ALTERNATING CURRENT GENERATORS

750 KVA Westinghouse 3 phase, 60 cycle, 460 volt, 150 RPM synchronous alternator.

560 KVA Allis 3 phase, 60 cycle, 240 volt, 360 RPM alternator.

500 KVA Westg. 3 phase, 60 cycle, 440/550 or 2300 volts, 514 RPM three bearing belted alternator.

400 KVA Allis 3 phase, 60 cycle, 480 volt, 240 RPM alternator.

300 KVA G. E. type ATI, 2300/440 volts, 720 RPM generator.

SPECIALS

5425 GPM Worthington 70' head, 1800 RPM centrifugal pump direct connected to 125 HP G. E. 3 phase, 60 cycle, 220 volt slip ring motor.

1 Allis-Chalmers jet condenser suitable for 2000 KW steam turbine-generator unit.

4400 sq. ft. Worthington surface condenser.

1250 sq. ft. Elliott surface condenser.

10 ton Capacity Brown hand operated traveling crane with 31'10" span including 150" of I-beams.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND 14, OHIO

WIRE OR PHONE
LONG DISTANCE 422

GLOW ELECTRIC CO

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
750	900	6600	Westgh.
360	514	440	GE-I
250	600	2300	Triumph
200	490	2200	GE
200	600	440	Westgh.-CS
150	600	2200	GE
125	1200	440	Century
100	1800	2300	Burke
100	1200	440	C-W
100	720	220	Westgh.
85	3600	2200	GE
75	900	2300	GE
75	720	2300	Wagner
75	360	220	GE-I
60	3600	2300	GE-KT
60	1800	440	Al. Ch.
60	1800	2300	GE-FTB
50	3600	440	R. & M.
50	1800	220	GE-KT
50	900	220	GE
50	720	2300	Wtg.-CS
40	1200	220	GE-KT
40	900	2300	Wtg.-CS
40	900	220	Lincoln
40	720	440	GE-KT
35	900	220	GE-KT
30	1800	dual	Delco
30	1200	dual	Master
30	720	220	GE-HI
30	514	440	Stanley
25	3600	dual	L-A
25	1800	dual	GE
25	1200	220	Wesche
25	900	440	GE
25	900	220	GE-FTB
25	720	220	Wagner
25	600	440	GE-I
20	3600	dual	GE
20*	1800	220/440	Master
20*	1800	220/440	Wesche
20	1200	440	Al. Ch.
20	900	440	Wtg.-CCL
20	600	220	GE
15	3600	220	GE-KT
15	1800	220	W-E
15*	1800	220/440	Master
15	1200	220	Ridgeway

ENCLOSED SQUIRREL CAGE

HP	RPM	Volts	Make
125*	1200	440	GE-TE-FC-BB
60	900	440	GE-TE-FC-BB
30	1800	dual	Delco
30	1200	440	Wagner
30	900	440	Reliance, TE-FC-BB
30	1200	440	Wagner
20	900	440	GE-TE-FC-BB
15	1800	dual	Delco
15	1200	220/440	Delco-TEFC-BB
15	900	440	GE, TE-FC-BB
10	1200	440	GE-TE-FC-BB
7½*	1800	dual	Wagner-TEFC-BB
7½*	1800	dual	Master-TEFC-BB
7½	1200	dual	GE-Hi Slip-TEFC-BB
7½	1200	dual	Delco
7½	900	dual	Delco-TEFC-BB
5	3600	dual	Delco-TE-FC-BB
5*	1800	dual	Master-TEFC-BB
5	1800	220	Wagner TE-BB
5*	1200	dual	GE-TEFC-BB
3	3600	dual	Delco, TE-FC-BB
3	1800	dual	Delco-TEFC-BB

*New Motor.

ENCLOSED SQUIRREL CAGE—Cont'd.

HP	RPM	Volts	Make
3	1200	dual	Rel-TEFC-BB
3	900	dual	Delco
2	1800	dual	Delco-TEFC-BB
2	1200	220	GE-TE-BB
2	900	220	Wagner-TE-BB
1½	900	dual	Delco-TEFC-BB
1½	1800	dual	L. Al-TE-BB
1½	1200	dual	Rel-TE-BB
1	3600	220	Haskins-TEFC
1	1800	dual	Master-TEFC-BB
1*	1800	dual	Delco-TE-BB
1*	1200	dual	Rel-TE-BB
¾	3600	4400	Delco-TE
¾	1800	dual	Wesche-TE-BB
¾	3600	220	Ohio-TE-BB
½	1800	440	Wtg.-TE-BB
½	1800	440	Delco-TE-BB
½	1800	dual	Delco-TE-BB
½	1200	220	Cr. Wh.-TE
½	900	dual	Delco
½	3800	dual	Delco
¼	1800	dual	Delco

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg.
400	1200	2300	Al. Ch.
400	514	4600	Al. Ch.
375	1800	2300	Al. Ch.
350	900	2300	Westgh.
250	300	2300	Al. Ch.
235	1800	220	GE-I
75	1800	220	GE
60	1800	dual	Al. Ch.
60	900	2300	Burke
60	900	220	Wesche
50	900	2300	Ridgeway
50	900	440	Wagner
50	720	440	Al. Ch.
50	1800	220	GE-MT
40	1200	220	GE-MT-336
40	900	220	Wtg.-HF
40	720	2300	Wtg.-HF
40	720	220	Al. Ch.-ARY
40*	600	2300	Al. Ch.-ARY
40	600	220	Al. Ch.-ARY
40	450	220	Triumph-C
35	1200	220	Westgh.
35	900	220	Al. Ch.
35	900	2300	Ridgeway
35	720	220	GE
35	900	2200	GE
30	1800	2300	Wtg.-CW
30	1800	220	GE
30	1200	440	Wagner
30	1200	2300	Lincoln
30	900	220	GE-MT
30	900	2300	F-M
30	720	220	GE-I
30	900	220	F. Morse-BV
25	1200	220/440	Watson-KH
25	600	220	Watson

VERTICAL MOTORS

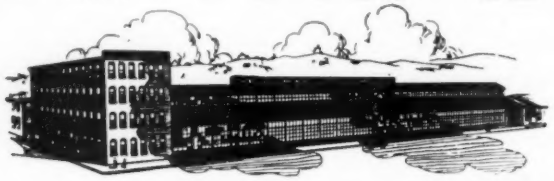
HP	RPM	Volts	Make
200	1200	440	Al. Ch.-6R
150	1200	2200	GE-I-5R
150	1200	440	GE-Cage

VERTICAL MOTORS—Cont'd

HP	RPM	Volts	Make
125	1200	2300	Al. Ch.-Cage
100	1200	440	GE-Cage
75	1200	2200	GE-Cage
75	360	220	Ideal-Cage
60	1800	230 D.C.	GE
60*	1200	440	Al. Ch.-Cage
50	1200	2200	Wtg.-Cage
50	600	440	Al. Ch.-Cage
40	1500	220	GE-Cage
40	1700	230 D.C.	GE
40	1200	440	Wtg.-8R
35	1800	440	GE-Cage
35	1200	2300	Al. Ch.-Cage
35	450	440	GE-Cage
30	1200	dual	Wtg.-Cage
25*	1550	230 D.C.	GE
25	1200	2200	GE-Cage
25	850	230 D.C.	Wtg.
20*	1500	440	Al. Ch.
20*	1200	440	Al. Ch.-Cage
15*	1800	440	Al. Ch.-Cage
15	1750	110 D.C.	Wtg.
15	1150	230 D.C.	GE
15	600	440	Al.-Ch.
12½	900	220	L. Al.-Cage
10	3400	230 D.C.	Wtg.
7½	1800	500 D.C.	Peerless
7½	900	440	Burke
7½	700	230 D.C.	GE
6	850	110 D.C.	Rel.
5	1400	230 D.C.	R. & M.
5	600	440	GE-Cage
4	1650	110 D.C.	Watson
3	1700	230 D.C.	Watson
3	1200	dual	Wtg.-Cage

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
3000	720	4800	GE-ATI
1015	900	2200	Wtg.-25 cycle
710	720	13200/6600	GE
500	600	4160	GE
280	720	440	GE-ATI
250	225	2200	GE-TS
220	600	2300	GE-ATI
200	225	2200	Wtg., rotor & stator
180	600	440	GE-ATI
115	164	208	GE
95	1200	220	Burke
75	1200	220	Westgh.
60	360	2200	GE, rotor & stator
50	1200	440	Wagner
50	900	220/440	Westgh.
50	720	440	GE-TS
50	360	440	GE, rotor & stator
30	900	440	Wagner
30	600	550	GE, rotor & stator
30	450	dual	Wtg., rotor & stator
30	360	550	GE
30	327	220	E-M, rotor & stator
25	1800	220	Wagner
25	450	220	E-M, rotor & stator
25	300	220	Ideal
20	1200	440	Wagner
20	900	220	Wtg.
20	600	220	E-M, rotor & stator
15	1800	220	Wagner
10	1800	220	Wagner
10	1200	220	Wagner
7½	1200	410	Wagner



AIR COMPRESSORS

2—Worthington, 11x12, horizontal, 328 CFM at 270 RPM Air Compressors, 100 lbs. pressure with or without motor.

1—Worthington, Feather Valve, 8½x9, horizontal, 170 CFM at 300 RPM Air Compressor, 100 lbs. pressure with or without motor.

D. C. MOTORS

115 Volts

HP	RPM	Description
225	750	GE-MPC
60	1200	Star
35	975	Northern
30	1800	F-M
30	200/600	Sprague
25	1150	Triumph
25	750	GE
20	700	Triumph
20	500/1600	GE-RF11
20	400/1200	GE-RLC fr. 202A
15	1200	J. & L.
15	975	F-M
15	725	Westgh.-8 fr. 6
10	650	J. & L. type C1
7½	3500	GF, type B
7½	1150	F-M, type CP
7½	975	Westgh.-8-8
7½	750	J. & L. type C1
7½	700	J. & L. type C1
7½	500/1600	Reliance-T-66T
7½	500	Westgh.-8K-BB
7½	170/220	Diehl-NG90
5	3600	Star-8F3-BB
5	1800	Wesche-BB
5	950	Swing-E-6

D. C. GENERATORS

125 Volts

KW	RPM	Description
500	750	GE-MCF
300	1500	GE-CC
100	1000	WE-DLC
100	900	C-W-CCD
80	400	J. & L.-G
65	1100	W-E, type ELC-7
60	1200	Star, type SQ single bearing
53	1000	GE-Type TD
35	1165	GE-DLC
31.25	1400	Westgh.-8K-single bearing

D. C. GENERATORS—Cont'd.

KW	RPM	Description
30	1200	Al. Ch., single bearing
25	1200	Westgh.-8K, single bearing
25	1100	GE-CL
25	600	Al.-Ch.-E-127
15	3600	GE-BF
15	1100	Al. Ch.
10*	1750	Westgh.-8K-42
10	1200	Delco, single bearing
9	1100	R. & M.
9	400	F-M
7½	3600	GE-BR
4	750	Westgh.-8K801
2	1400	Westgh.
2	1200	Westgh.-8K

D. C. GENERATORS

230 Volts

KW	RPM	Description
400	1200	Westgh.
200	375	J. & L.-type K
175	450	Westgh.
125	1400	Westgh.-8K-1301
50	1270	Al. Ch.-E-127
35	1800	GE-RC
30	300	Triumph
22½	765	Westgh.-8K
18	300	Burke
15	350	Westgh.-8K
15	250	GE-CD
5	1800	Reliance, BB
5	850	Triumph
1½	900	J. & L.-AI-7

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC EQUIPMENT
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

927 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

Actually one of AMERICA'S LARGEST STOCKS!

PARTIAL LISTINGS ONLY

Reliably Rebuilt—YEAR Guarantee

288 KVA. A.C. Output—D.C. Input Motor Generator Set

Westinghouse Factory Built. Complete. A. C. Generator, Switchboard, and D. C. Automatic Starter for Motor.

3 Phase—60 cycle—450 Volt or 240 Volt—.75 Power Factor—A. C. Output—900 R. P. M.

SQUIRREL CAGE MOTORS

H.P.	Make	Type	Speed
450	G.E. vert.	KF-6338	1180
250	G.E.	IK	1160
250	G.E. (2)	K-668	875
200	G.E.	KF-6335Z	880
147	West.	25 cy.	1750
125	A-C Ch. (2)	AR-630F	450
100	West.	CS-655C	1750
100	G.E. (2)	K-644	1175
100	G.E. (6)	K	1180
100	West.	CS	870
100	G.E.	K-6325	880
100	G.E.	KT-656	885
100	West. (2)	CS	690
75	West.	CS-505S	1760
75	West.	CS-662-C	1150
75	West.	CS	670
60	West.	504-S	1750
60	Rel.	AA-C50846	870
60	G.E.	FTR-523	3600
50	Elliott	196	3450
50	G.E.	K-645	1170
50	West.	CS	800
40	G.E.	KT-336	900
40	West.	CS	900

Partial List Only!

SLIPRING MOTORS

800	Cr. Wh.		514
200	G.E.	MTP	1800
150	G.E.	MT-564Y	580
100	G.E.	IM	1800
100	Al. Ch.		690
75	G.E.	IM	690
60	Al. Ch.		690
60	G.E.	M-6396	705
50	West.	CW-554	1155
50	Al. Ch.	ART	575
50	F-M	BV	575
50	G.E.	IM	490
40	G.E.	IM	1300

SYNCHRONOUS MOTORS

H.P.	Make	Type	Speed
800	G.E.	TS	900
400	G.E. (4)	TS-9828	600
260	G.E.	TS	900
200	Ideal (2)		257
150	G.E.	TS	1200
125	West.	G	1200
100	West.	G	1200
100	G.E.	TS	1200
100	Elec. Prods.		1200

A. C. GENERATORS

200 KW	West.	G	1200
75 KW	G.E.	ATB	360
75 KW	G.E.	ATB	1200

D. C. to A. C. GENERATORS

K.W.	Make	D.C.	A.C.
25	G.E.	230	220
25	Star	115	120
25	Ideal	115	440
25	El. Mchy.	230	440
7½	Hertner	115	440
5	El Spec.	110	110

550 V. D. C. MOTORS

H.P.	Make	Type	Speed
765	G.E. (6)	MPC	1045/1350

230 V. D. C. Variable Speed Motors

100	Rel.	1050-T	400/1200
100	G.E.	CD-173	400/1200
75	G.E.	D	500/1500
75	Cr. Wh.	CMC-125H	375/750
60	G.E.	C	480/1100
55	Cr. Wh.	CCM-125H	165/500
50	West.	SK	500/1500
50	West.	SK	250/1000
40	G.E. (3)	CD-1441	400/1500
25	West.	SA	500/1500
25	Rel.	185-T	500/1500
25	G.E.	RF-13	400/1600
25	G.E.	RF-14	400/1200
25	G.E.	RF-14	300/1200
20	G.E. (6)	RF-12	400/1200
20	West.	SK	375/1500
15	West. (4)	SK-95	600/1500
15	E.D.		500/1500
15	West.	SK-120	350/1000
15	West.	SK	250/1000
15	West.	SK	500/1500
10	G.E.	RF-10	600/1800
10	G.E.	CD-83	600/1800
10	West.	SK	600/1200
10	West. (3)	SK	500/1500
10	G.E.	RF	400/1600
10	G.E. (3)	RF	400/1200
10	Rel.	131-T	250/1000
7½	West.	SK-70	500/1500
7½	G.E.	RF-10A	450/1600
7½	Al. Ch.		350/1050
5	West. (3)	SK-50	500/1500
5	G.E.	RF-9	450/1800
5	G.E.	RF	450/1800
5	Rel. (2)	46-T	400/1600

600 V. GENERATOR

K.W.	Make	Speed
200	Cr. Wh.	900
30	Burke	1750
30	E.D.	1150

250 V. GENERATOR

K.W.	Make	Speed
500	West.	1100
330	Elliot	1200
300	G.E.	1200
300	Al. Ch.	1200
200	G.E. M-C	1200
150	West.	900
150	West.	1180
150	G.E.	600
50	G.E.	1200
30(3)	G.E.	1750
30	Cont.	1200
25	G.E.	1200
15	G.E.	1750
10	Star	1750
7½	West.	1200
5	West.	1750

125 V. GENERATOR

K.W.	Make	Speed
250	G.E.	720
150	Cr. Wh.	1200
150	West.	1150
100(2)	West.	900
100	G.E.	1200
100	El. Mchy.	1200
75	Cr. Wh.	1200
75	Hertner	1150
50	Sturt.	2800
40	Cent.	1450
30	L.A.	1450
30	G.E.	1150
20	Delco	1200
15	G.E.	1150
10	Rogers	1450
7½	West.	1200
5	G.E.	1750

LOW VOLTAGE GENERATOR

Amp.	Make	Voltage
8000	H-V-W	6/12
6000	M-B-O'C	6/12
5000	M-B-O'C(2)	6/12
2000	H-V-W	6/12
1000	Chandeyson	6/12
1000	Col.	6/12
125	Hobart(8)	7½
3000	Chandyson	12/24
1000	H-V-W	12/24
300	Star	15
67	Cons.	15
750	Star	15
1000	G.E.	15
800	G.E.	22/23
600	Rel.	24
134	West.	24
175	Cr. Wh.	25
550	Col.	27
1600	G.E.	30
800	G.E.	30
100	G.E.	30
200	West.	30
205	G.E.	32
1000	G.E.	33
205	G.E.	42
24	G.E.	44/54
75	G.E.	50/10
800	G.E.	50

230 V. D. C. MOTORS

150	G.E.	RC-19	800
100	G.E.	RC-14	1750
75	West.	SK-170	635
75	West. (2)	SK-180	475
75	Cr. Wh.	62-HM	480
60	West. (2)	SK-160	680
50	West.	SK-138	1300
50	Diehl	K-10	850

230 V. D. C. MOTORS (Cont.)

50	West.	SK	750
50	West. (2)	SK-140	585
40	West.	SK-103	1750
40	Century	DN-454	1740
40	G.E.	RC	1750
40	G.E.	RC-32	1100
40	G.E.	RC-13	1075
30	G.E. (2)	RC	1200
30	West (2)		975
30	G.E. (2)	RC-33	775
30	West. (2)	SK-148	875
20	G.E.	RC	1750
20	G.E. (2)	RC-11	1150
20	Star (2)	SR-316	39.3

115 V. D. C. MOTORS

100	Cr. Wh.	CMC	900
25	G.E. (2)	CD	1800
25	Cr. Wh.	CCM	750
20	Century	BB	1750
20	G.E. (2)	CD-83	1750
20	West.	SK-110L	750
12½	G.E.	CDM-85	930/1160

TRANSFORMERS

300 KVA—Al. Ch. 3 phase, 4160 V. primary 230 V. secondary.

300 KVA—Pittsburgh, 3 phase, 4160 V. primary, 230 V. secondary.

NEW D. C. STARTERS

150—230 V. Magnetic 5 H.P. to 75 H.P. G.E.—C-H—A-B—W.L., etc.

100—230 V. Manual and Compound 1 H.P. to 5 H.P.—G.E. & C-H.

40—7½ H.P. 230 V. C-H—Magnetic reversing.

A. C. STARTERS

1—475 H.P. West. Magnetic Reduced voltage, 550 V. synch.

4—400 H.P. 440 V. C-H Bal. 9976 Mag. Red. Volt. Synch.

1—250 H.P. C-H 4150 V. synch. full voltage.

1—150/200 H.P. G.E.—440 V. CR-7008 Syn.

3—150 H.P. G.E. 220 V. Cr. 7061 Synch.

NEW A. C. STARTERS

40—C-H. & A-B 2 and 4 speed Magnetic up to 25 H.P.

20—50 H.P. C-H. 440 V. Magnetic.

165—20 H.P. W.L. 440 V. Magnetic.

635—7½ H.P. C-H. 440 V. Magnetic.

AIR COMPRESSORS

425 Cfm. Sullivan 2 stage.

360 Cfm. American 125 lbs.

ELECTRIC & AIR HOISTS

17—2 ton Shepard-Niles 230 V. D.C.

8—500 lbs. P & H. Zip Lift, 3 phase.

2—2 ton Yale & Towne, 3 phase.

1—1 ton Shepard-Niles, 3 phase.

1—½ ton Yale & Towne, 3 phase.

1—2 ton Thor, pneumatic.

1—½ ton Thor, pneumatic.

400 CY. GENERATORS

2—3 K W GE 3/400/110.

2—7½ K W GE 3/400/240.

1—10 KW GE 200/700 Cy.

1—15 KW GE 3/400/240.

EST. 1910 → L. J. LAND INC. ← 39TH YEAR

New England Representative:
BOSTON, MASS.
411 Atlantic Ave.
Phone: Liberty 4300

156 GRAND ST., NEW YORK 13, N. Y.
PHONE: CAnal 6-6976

South Western Representative
HOUSTON, TEXAS, 1400 Carr St., Phone: Charter 4-6558

Pennsylvania Office:
READING, PENNA.
10th & Exeter Sts.
Phone: Reading 2-6866

Our 43rd Year

WAGNER

Quality and Service

"CERTIFIED REBUILT"

THE MARK OF DEPENDABLE ELECTRICAL EQUIPMENT

MOTORS . . . GENERATORS . . . M-G SETS

PUMPS . . . FANS . . . BLOWERS . . . SPEED REDUCERS

PARTIAL STOCK LISTING—WRITE, WIRE OR PHONE YOUR REQUIREMENTS

250 KW Allis-Chalmers M-G Set, DC 120/240V. output, 363 H.P. Synch. Motor, 3/60/440V. 1200 RPM, AC & DC panels, late model.

M-G SETS

KW	Mfr.	Input V	Output V
150	Cr. Wheeler*	220/440 AC	250 DC
105	Century b.b.	220/440 AC	70 DC
100	Gen. Elec.*	220/440 AC	125 DC
100	Whse. converter	440 AC	250 DC
75	Whse.	220/440 AC	125 DC
75	Star b.b.*	220/440 AC	250 DC
75	Star b.b.	240 DC	230/460 AC
50	Gen. Elec.	220/440 AC	125 DC
40	Whse.	220/440 AC	250 DC
35	Gen. Elec.	220/440 AC	48 DC
30	Ideal	220/440 AC	125/250 DC
30	Elec. Prod.*	220/440 AC	50 DC
25	G. E. NEW	220/440 AC	125 DC
30	Whse.	220/440 AC	250 DC
20	Cr. Wheeler	220/440 AC	180 cycles
15	Gen. Elec.	220/440 AC	125 DC

*Synch. motor drive.

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
150	Cr. Wheeler b.b.	TEFC	230	800
100	Whse.	SK181	230	50/900
100	Gen. Elec.	C	230	575/1000
75	G.E. New b.b. (2)	CDM	230	1750
75	Cr.W. New b.b.(2)	CMC	230	1150
75	Allis Ch.	E	230	500
75	Whse.	S13L	115	575
75	Gen. Elec.	BRC	115	1150
75	Northw'n.	K20	230	1750
65	Gen. Elec.	C	230	375/750
60	Whse.	SK	230	1700
50	Reliance	262T	230	1150
40	Sprague dyna.	LC	230	750/2000
40	Whse.	SK133	230	850
35/50	Gen. Elec.	CD123	230	575/1150
35	Ideal (2)	DV350	230	400/1200
30	Whse.	S-7	115	900
30	Gen. Elec.	RC31B	230	1150
28	Gen. Elec.	RC31	230	1150
28	Sprague dyna.	LC	230	750/2000
25	Chand'son(4)	C13	115	850
25	G.E. b.b. NEW	CDM93	115	1150
25	Gen. Elec.	CD85	230	1750
20	Gen. Elec.	RF12	230	400/1600
20	Whse.	SK93	230	1150
20	G.E. b.b. NEW	CDM83	115	1750
20	Gen. Elec.	RC11	115	1150
20	Reliance	T	230	850
20	Gen. Elec.	DLC	230	500/1800
20	Gen. Elec.	CD85	230	1150
15	Gen. Elec.	LC	230	550/1100
15	Roth	85RS	230	1750
15	G.E. b.b. NEW	CDM67	115	1750
15	Gen. Elec.	RC10	230	1150
15	Whse.(5)	SK90	230	825
15	El. Dyn. b.b. (2)	326	230	1750

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
150	Cr. Wheeler b.b.	TEFC	250	1200
105	Century b.b.	1500a	70	1200
100	Gen. Elec.	RC17	125	1200
100	Gen. Elec.	C	250	750
75	Allis Ch.	E	250	750
75	Whse.	S	125	600
75	Cr. Wheeler b.b.	CCD	250	1450
50½	Reliance	T	250	1200
40	Whse.	SK	250	1150
30	Elec. Prod.	BB	50	1150
30	Gen. Elec.	RC	250	1500
30	Ideal 3 wire	HHR	125/250	850
28	G.E. NEW b.b.	CD93	125	1450
24	Whse.	SK	500	850
20	Reliance	T	250	1150

EXPLOSION PROOF MOTORS
from 1 to 20 H.P.....std. speeds

Turbo-Generator Bargain!
375KVA Whse. 3/60/240/480V. Non-Cond.

A. C. MOTORS—25 CYCLE

H.P.	Mfr.	Type	Volts	Speed
150	Whse.	HF	440	500
150	Gen. Elec.	IK-16	440	750
50	Allis Ch.	ANY	440	750
50	G.E. int.	MTC5337	440	750
50	Allis Ch.	ANY	440	1500
50	G.E.	I-K	440	750

A. C. GENERATORS—60 CYCLE

KVA	Mfr.	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
500	Allis Ch.	3 brg.	240/480	350
375	Whse.	G	240/480	900
250	Whse.	G	2300	600
200	Gen. Elec.	ATB	240/480	600
156	G.E. 1 brg.	ATB7558	240/480	1200
150	Gen. Elec.	ATB	240/480	600
125	Whse.	G	240/480	720
125	Gen. Elec.	ATB	240/480	300
100	Whse.	G	2300	900
100	Gen. Elec.	ATB	240/480	1200
63	El. Machy.	180 cy.	240/480	1800
56	Gen. Elec.	ATB	240/480	900
50	Cont. b.b.	S107	120/208	1200
25	Whse. b.b.	1 ph.	120/240	900
12½	Whse. b.b. NEW		240	1200

A. C. MOTORS—SLIP RING
3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	600	Gen. Elec.	I-M	360
1—	450	Whse. 2200 V.	CW	600
1—	400	Whse. 2200 V.	CW	450
1—	300	G.E. 2200 V.	I-M	1800
1—	150	Whse.	HF13AH	720
1—	150	G.E. 2200/4000 V.	I-M	1200
1—	150	G.E. int. duty	ITC-15	720
1—	150	Allis Ch.	ANY	600
1—	125	Gen. Elec.	IM-15	720
1—	100	Allis Ch.	ANY	1500
1—	100	Al. Ch. b.b. NEW	ARV	600
1—	100	Allis Ch.	ANY	720
2—	100	Whse. int. 2200 V.	C1856C	600
1—	100	Allis Ch.	ARV	900
2—	75	Gen. Elec.	IM-14	720
1—	75	G.E. int. duty	MTC5342	900
1—	75	Ideal int.	AVE	1200
1—	75	Gen. Elec.	MT558	600
2—	75	Gen. Elec.	IN-14	600
1—	75	Gen. Elec.	MT337	1800
2—	50	Allis Ch.	ANY	900
1—	50	Howell	FR437	1200
1—	50	Fair. Morse	BV	720
1—	50	Gen. Elec. int.	ITC	600
1—	50	Whse. int.	CI	900
1—	50	Gen. Elec.	I-M	720
1—	40	Gen. Elec.	MT336	900
1—	40	Gen. Elec.	MT327	1800
1—	37	G.E. int.	ITC	600
1—	30	Gen. Elec.	OM7338	1200
1—	30	Gen. Elec.	M7346	600
2—	25	Gen. Elec.	MT332	900
1—	25	Triumph	8R	1200
1—	25	Gen. Elec.	I-M	600
1—	20	G.E. int.	MTC5312	900
1—	20	G.E. b.b.	MT503	1800
1—	20	Gen. Elec.	MT332	720
2—	20	G.E. int.	MTC5302	1200
1—	15	Gen. Elec.	MT502	1200
1—	15	P & H b.b. int.	W7	1200

A. C. MOTORS—SYNCHRONOUS

H.P.	Mfr.	Type	Volts	Speed
667	Gen. Elec.	ATI	2200	450
300	Whse.	G	2200/440	600
250	Ideal	2BC-M4	2200	450
229	G.E. 3 brg. 8 PF	ATI	2200/440	600
150	Gen. Elec.	ATI	2200	450
150	Gen. Elec.	ATI	220/440	300
150	Gen. Elec.	ATI	220/440	600
125	Whse.	G	2300	900
125	G.E. splprf.	TS955	220/440	1200
100	American b.b	YGH	220/440	900
60	Gen. Elec..	ATI	220/440	900

A. C. MOTORS—SQUIRREL CAGE
3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	300	Gen. Elec.	IK-14	1200
1—	200	Reliance b.b. NEW	C6085	1200
1—	200	Reliance b.b. NEW	C6085	1800
1—	200	Allis Ch.	AN	1200
1—	200	L. Allis 2200/3800 V.	OGK-144	900
1—	150	Allis Ch. 2200 V.	b.b.	720
1—	150	Reliance b.b. NEW	14C6085	720
1—	150	Whse. 2200 V.	C8771-1C	1800
1—	150	Reliance b.b. NEW	B6085	1200
1—	150	Reliance b.b. encl.	AA	900
1—	125	Reliance b.b. NEW	C5085	1200
2—	125	Allis Ch. 2200 V.	AN	1200
1—	125	Gen. Elec.	IK-16	450
1—	125	Cont. 2200 V. b.b.	SC	1800
1—	125	Rel. TEFC NEW	B6085	1800
1—	100	Reliance b.b. NEW	C5085	900
1—	100	Elec. Machy.	b.b.	1200
1—	100	Rel. TEFC NEW	C5085	1200
1—	100	G.E. b.b. NEW	K5043	1800
1—	100	Cont. TEFC	NP682	1200
1—	75	Reliance b.b. NEW	C5084	900
1—	75	Reliance TEFC NEW	C5084	1200
1—	75	Reliance b.b. NEW	C505	1800
1—	75	Gen. Elec.	KT329Y	3600
1—	75	Whse. hitorq	CS-807	1200
2—	75	Reliance b.b. NEW	C505	1200
1—	60	Gen. Elec.	KT 346	900
2—	60	Reliance b.b. NEW	B504	1800
2—	60	Rel. TEFC NEW	C505	1200
2—	60	Reliance b.b. NEW	C504	1200
2—	60	Whse. H. T.	CS504	1800
1—	60	Wagner b.b.	RP444	3600
1—	60	Allis Ch. 4000/2200 V.	AR833	1800
1—	50	Whse. b.b. NEW	CS4068	1800
1—	50	G.E. 2 phase	I-Q	900
2—	50	G.E. NEW b.b. HT	KG405	1800
2—	50	Reliance b.b. NEW	C445	1200
2—	50	Gen. Elec.	KT338	1200
1—	50	Gen. Elec.	KT342	900
2—	40	Whse. hallp	WL407	900
1—	40	Al. Ch. 3 speed	ARX 900/800/450	
2—	40	Gen. Elec.	KT336	900
2—	40	Reliance b.b. NEW	C404	1800
2—	40	Rel. TEFC NEW	C445	1200
2—	40	G.E.	KT	1200
2—	35	Gen. Elec.	I-K	720
2—	30	Howell b.b. speed	SC	1800
2—	30	G.E. NEW b.b.	K365	1800
2—	30	G.E. NEW hitorq	KG765	1800
2—	30	G.E. TEFC b.b.	K404	1800
1—	30	Gen. Elec.	I-K	900
1—	30	Gen. Elec.	KT338	720
1—	30	Wagner	2PT8P	900
1—	30	Whse.	CS948	900
2—	30	Reliance b.b. NEW	C405	1200
2—	30	Reliance TEFC NEW	C444	1200
3—	30	Cr. Wheeler b.b.	SC 30Y	1800
2—	25	Rel. TEFC NEW	C444	900
3—	25	Reliance b.b. NEW	C364	1800
2—	25	Reliance TEFC NEW	B365	1800
2—	25	Reliance b.b. NEW	C404	1200
2—	25	Reliance TEFC NEW	C405	1200
3—	25	Whse. NEW spl. b.b.	CS365	1800
1—	25	Gen. Elec.	IK	1200
3—	25	Whse.	CS648	900
2—	25	Gen. Elec.	I-K	600
1—	20	Reliance b.b. NEW	C404	900
1—	20	G.E. TEFC b.b.	K404	1200
4—	20	Reliance b.b. NEW	C364	1800
2—	20	L.A. NEW exp. prf.	EX364	1800
2—	20	Whse. NEW b.b. spl.	CS364	1800
2—	20	Gen. Elec.	KT312	1200
2—	20	Gen. Elec.	I-K	1200
1—	20	Whse.	CS	1200
2—	20	G.E. NEW b.b.	K365	1200
2—	20	Diehl TEFC NEW	INF364	1800
2—	20	Century b.b. 4 speed	SC594	1800
2—	15	Whse. Splashprf.	CS365	1200
4—	15	G.E. NEW b.b.	K324	3600
2—	15	Whse. NEW TEFC	CS326	1800
1—	15	Diehl TEFC NEW	INF765	1200
4—	15	Gen. Elec.	KT302	1200
1—	15	Gen. Elec.	KT512	900
1—	15	L. Allis	OX365	900

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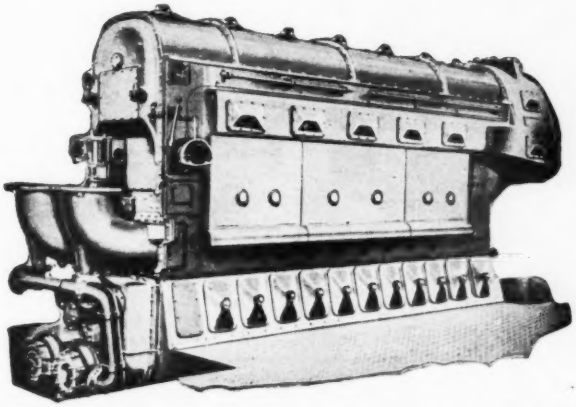
1436-38 W. RANDOLPH STREET CHICAGO 7, ILL. MONroe 7409

1250-KVA Diesel Engine-A. C. Generator Sets-Complete with Switchgear, Shaft Exciter Etc



FAIRBANKS-MORSE 1600-HP. Model 38D8 ⅛, OP Cyldrs. 720-RPM. Diesel Engines Connected to NEW (Unused) Crocker-Wheeler 1250-KVA. Generators. Complete Units. SEVERAL IN STOCK: IMMEDIATE DELIVERY: WRITE FOR DRAWINGS, PRICES
WE SPECIALIZE IN DIESEL-GENERATOR SETS: Send us your Specifications
Several Nordbergs: 1250-HP., G.E., West. Generators: 600-HP. Fairbanks-Morse Diesel-Generator Set. 400-KW. Generator.
4—600-HP. COOPER-BESSEMER DIESEL ENGINES.
Always secure Weaver's Prices: Are Money Savers

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WE OWN OUTRIGHT AND CARRY ONE OF THE LARGEST STOCKS IN THE USA
STOCK IS TOO LARGE TO ITEMIZE HERE:
SEND US CAPACITY, STEAM PRESSURE, VOLTAGE: We will do the rest.

CONDENSERS NEW AND NEW AUXILIARIES: BEST MAKES: LATEST DESIGNS
FOR IMMEDIATE DELIVERY

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NEW—5000-KVA., G.E., 600#-psi., 750° FTT.
Aut. Extra. Non-condg. New 1075-KVA. 450#
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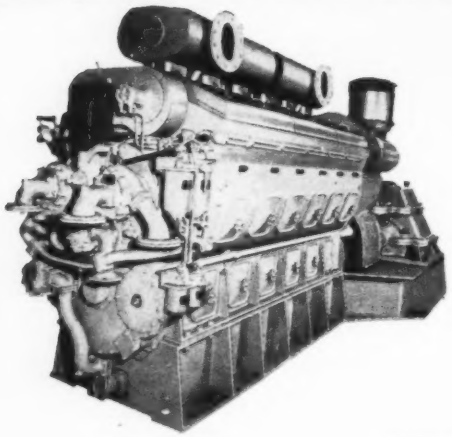

900 HP
General Motors
12-567
Diesel Engine

CONDENSERS

(Most are new)

No.	Sq. Ft.	Make	Passes	Tubes	
4	3300	Str. Wells	2	Alu-Brass	¾"
1	2200	Alco	2		
4	1050	Conseco	2	Cu Ni	⅝"
1	750	Bethlehem	2		⅝"
30	400	All. Chalm.	2	Brass	⅝"
4	300	Wheeler	2		
8	155	Conseco	2	Brass	¾"

BOILERS

10—Cleaver-Brooks, 2000# steam pr. hr. 35# press.

3—Cyclotherm 3000 pounds steam per hour, 125# press.

6—Express Boilers, modified D type, Foster Wheeler 30,000# steam hr., 435#.

2—Type "D", water tube, Foster Wheeler, 15000# steam hr., 275#.

HYDRAULIC PUMPS

5—Vertical quintuplex, 4⅝ x 10, 450 gpm at 128 RPM against 2500 p. s. i., mid. by Aldrich driven by 700 HP synchr. motors 3/36/2300.

BLOWERS—AIR PUMPS

8—Blowers, Roots Connersville, size 16x18, serial No. 14862, capacity 5000 CFM against 6 lb. sq. in. ga. pressure or 3450 CFM when creating 20" Hg vacuum, with 200 HP motors 3/60/2200 (mid. 1942). Also available: 1 R.C. Blower, size 20 x 23 with 350 HP motor.

1—Air Pump, Ingersoll Rand, type FS546, 5500 CFM, discharge press. 24.22 abs., intake press. 20.61 abs., with 125 HP motor 3/60/2300 (mid. 1942).

1—Air Pump, Ingersoll Rand, type FS548, 6690 CFM, discharge press. 20.86 abs., intake press. 17.10 abs., with 150 HP motor 3/60/2300 (mid. 1942).

1—Blower, Buffalo, size 60, type R, with 150 HP motor 3/60/2200.

4—Vacuum pumps, Nash Hytor, size MD574, with 2 HP motors 230V DC (mid. 1944).

AXIAL FLOW FANS

12,000 CFM, 3" S.P. 3/60/450 Sturtevant
10,000 CFM, 3" S.P. 3/60/450 Clarage
5,000 CFM, 3" S.P. 3/60/450 La Del
35,000 CFM, 1" S.P. 230V. D.C. Wing

Rugged construction, acid resisting vanes, totally enclosed motors, all NEW

DISTILLING PLANTS

2—40,000 gallons per day, Foster Wheeler triple effect low pressure.

10—2000 gals. per day Kleinschmidt vapor compression distiller mfd. by Badger.

1—750 gals. per day, same as above.

MOTORS

3 Ph. 60 Cy.

6—3800 HP 1700 V 257 RPM G.E
5— 700 HP 2300 V 128 RPM

D.C.

1500 HP 525 V DC 600 RPM W'hse.
667 HP 374 V DC 1300 RPM Elliott
444 HP 250 V DC 900 RPM Elliott
222 HP 230 V DC 3050 RPM W'hse.

GENERATORS

1200 KW 525 V DC 750 RPM All. Chalm.
1075 KW 375 V DC 750 RPM Elliott
700 KW 240 V DC 500/720 Elliott

TURBO-GENERATORS—A.C.

1—1000 KW All. Chalmers 3/60/600, 3600 RPM, cond., 140# steam press.

3—300 KW G.E. type AT1 3/60/450, 1200 RPM, cond., compl., with 40 KW exciters, condensers, switchboards.

2—250 KW G.E. type AT1 3/60/450, 1200 RPM, cond.

2—200 KW Westinghouse, 3/60/450, 1200 RPM cond. (NEW).

6—200 KW G.E. type ATB 3/60/450, 1200 RPM cond. and non-cond.

2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

TURBO-GENERATORS—D.C.

KW	Volts	Winding	Speed	Type
2—375	180/240	Shunt.	1200	non-cond.
5—300	120	Compd.	1200	cond.
1—300	120/240	Compd.	1200	cond.
2—250	240	Compd.	1200	cond.
12—150	120	Shunt.	1200	cond.
12— 60	120	Stab. Sh.	1800	cond.
3— 25	120	Stab. Sh.	1200	cond.

FIRE PUMPS

2—1000 GPM, 280 ft. head, bronze, 6" x 5", Allis Chalmers, driven by Hercules Diesels, model DWXDS, 90 HP at 1800 RPM.

30—500 GPM, 120# press. at 2450 RPM, 750 GPM, 200# press. at 2900 RPM, with 160 HP White gasoline motor, 6 cycle, L-head type or 110 HP Cadillac, type V-8 (engines for sale separately).

ICE PLANTS (New)

2—22 ton capacity, Freon 12, mfd. by Frick.

HOISTS

10—100,000# pull at 10 FPM to 3000# pull at 400 FPM. 2 Gypsies 12000# pull at 125 FPM, driven by 50 HP 230v. D.C. motors 525—1800 RPM.

15—15,000# pull at 78 FPM, 3360# pull at 348 FPM and 2 auxiliary drums. Driven by Chrysler 28.35 H.P. gasoline engines. (NEW).

DIESEL ENGINES

HP	MAKE	MODEL	RPM	CYCLE	YEAR
1800	General Motors	16-258S	750	4	1943
1600	Fairbanks Morse	38D O/P	720	2	1944
1600	Hamilton	RB99-D.A.	700	2	1944
1600	General Motors	16-278A	720	2	1944
1200	General Motors	12-278A	750	2	1944
900	General Motors	12-567ATL	750	2	1942/44
500	Baldwin	6-cyl.	514	4	
300	Fairbanks Morse	38-O/P	1900	2	1936
225	Gray Marine	4½" x 5"	2100	2	1943
150	Superior	GDB-8	1200	4	1942/44

DIESEL GENERATOR SETS

AC	200 KW	3/60/450	1200 RPM	General Motors	8-268A	1943 rebuilt
	100 KW	3/60/450	1200 RPM	General Motors	3-268A	1943 rebuilt
DC	1200 KW	525V	750 RPM	General Motors	16-278A	1943
	650 KW	240V	750 RPM	General Motors	12-567	1943
	125 KW	120/240	600 RPM	Superior	VDM8	
	100 KW	120/240	1200 RPM	Superior	GDB-8	1942/44
	100 KW	120/240	1200 RPM	General Motors	3-268A	1943/44
	10 KW	120	1200 RPM	Hercules	DOOD	1943

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POWER EQUIPMENT—READY TO SHIP

SAVE OVER 50% ON NEW INDUSTRIAL BLOWERS AND VENTILATING FANS

AXIAL FLOW VENTILATING FANS

6—16000 CFM Buffalo Forge Co., 3" stat. pres. 1800/1200 rpm. con. 15/4.5 HP., 1710/1150 rpm., 3 ph. 60 cy. G.E. A.C. Motor 220/440 v. totally encl.

2—12000 CFM 3" stat. pres. Sturtevant with dir. con. 10/3 HP., 1775/1180 rpm., 220/440 v. West. CS. TEFC Motor.

1—7800 cfm Clarage with dir. con. 7½ hp., 1750 rpm., 3.3 HP. at 1160 rpm., 220/440 v. 3 ph. 60 cy.

31—6000 cfm Sturtevant Bulletin 512289, 3" stat. pres. 7 blade, dir. con. 5/1.6 HP., 1765/1175 rpm., 220/440 v. 3 ph. 60 cy. West. TEFC Motors.

2—5000 cfm Sturtevant 1.8 stat. pres. 4.2/1.25 HP., 1750/1150 rpm., 3 ph. 60 cy. 220/440 v. ball bearing motors.

2—4000 cfm 3" stat. pres. Sturtevant dir. con. 2 speed, TE Westinghouse 220/440 v. Motors.

BRAND NEW TURBO SET

Westinghouse Steam Turbine consisting of 200 kw., 220/440 v., 3 ph. 60 cy. 1200 rpm., 80% P.F. A.C. Generator—40 kw., 120 v. 1200 rpm., D.C. Exciter and Westinghouse Reduction Gear. — Non-condensing.

A.C. MOTORS—3 PH. 60 CY.

No.	H.P.	Make	Type	RPM	Volts
1 new	500	Elec. Mach.	Syn.	120	4000/2200 220/440
3	300	Elec. Mach.	Syn.	720	2200
2	250	G.E.	I	1200	2200
2	200	G.E.	I	880	2200
1	200	West.	CS	900	440
1	175	West.	MS	900	220
1	150	West.	MS	900	220
1	150	West.	Syn.	600	220/440
1	150	West.	Syn.	257	220/440
4	150	L. Allis	Splash Proof	1800	220/440
1	125	Elec. Mach.	Syn.	164	220/440
2	100	Reliance	IT	495	220/440
3	100	Elec. Mach.	Syn.	720	220/440
1	100	Allis Chal.		1200	220/440
1	100	West.		1200	220/440
2	100	Louis Allis	OGS	1750	220/440
5	100	Louis Allis	PA	1750	220/440
1	75	Stanley		3600	220/440
1	75	Chandey	Syn.	600	220/440
1	75	Elec. Mach.	Syn.	900	220/440
1	75	Louis Allis	OGS	1200	220/440
2	75	Louis Allis	FAA	1150	220/440
1	75	G. Elec.	KT-543	1150	220/440
3	75	Armour	AXB	1180	220/440
1	75	Burke	EM-7	1200	220/440
2	75	West.	CS	1800	220/440
1	60	Burke	EM-7	900	220/440
1	60	G.E.	KT-543	900	220/440
3	60	Armour	AXB	900	220/440
1	60	West.	CS-655	1200	220/440
1	60	G.E.	KT-533	1800	550
1	50/32	G.E.	FOS	800/640	220/440
1	50	West.	CS-655-A	870	220/440
1	50	Fynn-Weis.	22-V	900	220/440
2	50	G.E.	KT-346	900	220/440
1	50	G.E.	KT-342	1200	220/440
1	50	West.	CS	1200	220/440
1	50	American		880	220/440
1	50	G.E. T.E.F.C.	K-445	1770	220/440
1	50	West.	M-S	1800	220/440

A. C. GENERATORS—3 ph. 60 cy.

No.	KVA	Make	RPM	Volts
1 new	450	Elec. Mach.	120	4000/2200 220/440
3	115	Elec. Mach.	720	220/440
1	100	Elec. Mach.	164	220/440
1	100	West.	600	220/440
1	75	Elec. Mach.	900	220/440
1	50	G.E.	1200	220/440
1 new	50	Elec. Mach.	1200	220/440
1	37½	Ft. Wayne	1200	220/440
1 new	35	G.E.	900	220/440
4	25	O'Nan	1800	220/440

BARGAIN — FOR SALE
100 KW. DIESEL ENGINE GENERATOR SETS

11—100 KW., 120/240 V. D.C. Delco Generators dir. con. to 150 HP., Model GBD-8, 5¾x7, 8 cyl. Superior Diesel Engines, elec. starting with muffler, power panel and accessories.

2—100 kw 220/440 V AC same as above.

Practically as good as new—Only Used for Spares.

250 VOLT D.C. GENERATORS

No.	KW	Make	Type	RPM
3	250	West.	SK	1200
1	200	West.	SK	600
1	110	West.	SK-190	700
8	100	Reliance	1050-T	580
1	100	West.	SK-183	720
1	100	West.	SK-190	720
1	100	West.	SK-180	900
6	100	Delco		1200
1	100	G.E.	RC-58	850
1	100	West.	SK	850
1	100	G.E.	RCP-36	2100
1	75	Allis Chal.		850
2	75	West.	SK	1400
1	60	West.	SK	2100/1950
1	60	West.	SK-153	1100
1	50	West.	SK-180	400
1	50	G.E.	DLC-203	850
1	50	West.	SK-143	1100

MOTOR GENERATOR SETS—250 V.D.C.
Motors 220/440 volt or 2200 volt 3 phase, 60 cycle

No.	KW	Make	RPM
3	250	Westinghouse	1200
1	200	Westinghouse	720
2	200	Westinghouse	1200
1	100	Westinghouse	700
1	100	General Electric	900
1	100	Westinghouse	600
1	100	General Electric	1800
1	100	Reliance	580
1	100	Delco	1200
2	90	Westinghouse	680
4	75	Westinghouse	720
1	75	Westinghouse	1200
1	60	Westinghouse	1200
1 NEW	50	General Electric	1800
3	40	Westinghouse	900
2	30	Westinghouse	720

VARIABLE SPEED MOTORS—230 V. D.C.

No.	HP	Make	Type	RPM
1	200	West.	SK	400/1000
8	100	Reliance	1050-T	400/1000
1	100	G.E.	RC	650/1200
2	100	West.	SK-183-A	575/1150
1	100	West.	SK-190	500/1000
1	100	West.	SK	600/1200
1	75	West.	SK	1100/1800
2	75	West.	SK	850/1700
1	50	West.	SK-180	320/960
1	50	West.	SK	300/1200
1	50	West.	SK-191	350/1050
1	50	West.	SK-143	950/1750
1	40	Allis Chal.		400/1200
2	30	G.E.	DLE-50	400/1200
1	30	G.E.		800/1200
1	25	G.E.	CD-123	300/1200
1	20	West.	SK-123	400/1600
1	20	G.E.	RF-11	500/1500

SURFACE COMBUSTION GARDEN CITY HEAT TYPE EXHAUSTERS

3—#55 Single SSP, 14000 cfm at 1292 rpm., S.P. @ 70 deg. F and 3" water for 1200 deg. F. operation.

SPECIAL BARGAIN AIR COMPRESSOR

6—240 CFM Westinghouse type 3 VS-23 3 cyl. vert., 150 lbs. pres. dir. con. to 50 HP., 220/440 or 2200 v. 3 ph. 60 cy. West Slip Ring Motors, auto. control. Can furnish D.C. Motors or Oil or Gasoline Engines if desired.

SLIP RING MOTORS—3 ph. 60 cy.

No.	H.P.	Make	RPM	Volts
1 New	400	West.	600	2200
1	250	Allis Chal.	870	2200
1 New	200	G.E.	600	220/440
1	200	West.	1800	220/440
1	150	G.E.	1800	220/440
1	150	West.	1150	220/440
1	125	West.	860	2200/220/440
1	100	West.	720	2200/220/440
1	100	Triumph	580	550/220/440
1	75	G.E.	600	550/220/440
1	75	G.E.	720	220/440
1	75	G.E.	900	220/440
1	75	West.	1800	220/440
1	60	West.	900	220/440
1	60	G.E.	720	220/440
2	50	West.	870	220/440/2200

25 CYCLE A. C. MOTORS
3 ph. — 220-440 volts

H.P.	Make	Type	RPM
150	West.	CW	400
100	West.	CW	735
75	West.	MS	400
75	G.E.	M	715
60	West.	CS	1450
50	L. Allis	OGS-115	730
50	Armour	AB-1	720
50	West.		473
40	West.		725
25	West.	MS	715
20	West.	CS	715
20	Allis Chal.		715
15	Allis Chal.		1450
10	West.	CS	725

REDUCED VOLTAGE STARTERS—220 V. 3 ph. 60 cy.

7—100 H.P. Westinghouse Class 11-400

HUNDREDS of A.C. & D.C. BRAND NEW STARTERS all sizes—Gov. Surplus—BARGAIN PRICES

FREQUENCY CHANGERS

1—25 kw., 220/440 v. 3 ph. 180 cy., G.E. dir-con. to 25 HP., 1800 rpm., 220/440 v. 3 ph. 60 cy. motors.

SYNCHRONOUS MOTORS

1—New 500 HP., Elec. Machy. Co. 2200/220 or 440 v. 120 rpm.

ENGINE GENERATOR SETS

10—NEW 1 kw, 14.25 v. D.C. and 2 kw., 28.5 v. D.C. Homelite portable gas eng. Gen. sets. Can furnish lamps and batteries. Suitable for farms and camps.

3—5 kva. 120/240 v. 1 ph. 60 cy. Witte Diesel.

1—50 kva. Elec. Machy 220/440 v. 3 ph. 60 cy. dir. con. Climax GASOLINE Engine.

1—125 kva. 220/440 v. 3 ph. 60 cy. 257 rpm., Erie Ball STEAM.

1—125 kva. G.E. 220/440 v. 3 ph. 60 cy., dir. con. Skinner UNIFLOW Engine.

INDUCTION HEATING CONVERTER

New Van Norman, type indoor, floor, hi-freq. 32 kw. 220 v. 1 ph., 60 cy. 150 A. enclosed type.

HOISTS or WINCHES

200—1½ Ton HAND CRANKED ratio 27:1 thru an enclosed double reduction gear unit with 4 planetary gears mounted on steel plate complete with 48' of ¼" cable, ratchet type brake, push button release.

CAR PULLER or WINCH

1—Welen, 2 drum Winch or Car Puller rated 8600# per drum with 25 HP. G.E. Vertical Motor 230 v. D.C.

GEAR HEAD MOTOR

50 HP., G.E. 220/440 or 550 v., 3 ph. 60 cy., 1755 to 13 rpm., splash proof, ball bearing.

PORTABLE COMPRESSOR

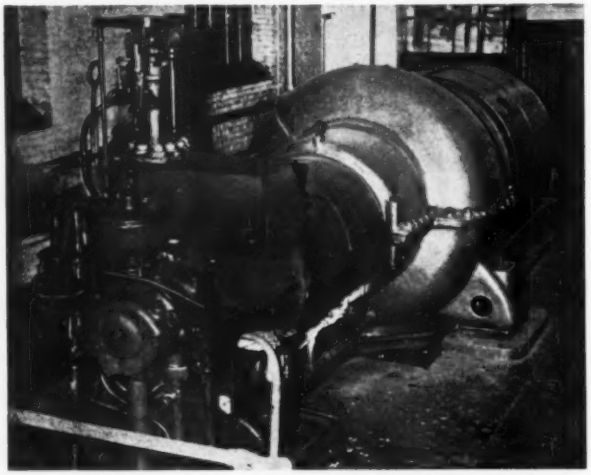
1—315 CFM Ingersoll Rand portable 100 lb. pres. driven by 105 HP Waukesha Oil Engines, 850 rpm.

FOR SALE OR RENT

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

STRICTLY UTILITY, EFFICIENT CONDENSING STEAM TURBO-GENERATOR UNIT



AVAILABLE

IMMEDIATE SHIPMENT

General Electric, 3600 RPM condensing steam turbo generator unit consisting of:

TURBINE

1500 KW, 17-stage, 225-250 P.S.I., 100° F.S. direct connected to:

ALTERNATING CURRENT GENERATOR

1500 KW, 80% P.F.—1875 KVA, Type ATB-2, Form HT, 3 phase, 60 cycle, 471 Amp., 2300 volts, complete and equipped with

ACCESSORIES

3500 sq. ft. C.H. Wheeler surface condenser, condensing auxiliaries, piping, valves, duplicating exciter sets, switchboard and instruments.

EXCELLENT CONDITION

UTILITIES ELECTRICAL MACHINERY CORPORATION

600 NATIONAL CITY BANK BLDG. *Long Distance Phone 422* CLEVELAND 14, OHIO

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—3500 KW 2300 V Cond.
1—2500 KW 600 V Cond.
1—2500 KW 2300 V Cond.
1—3000 KW 600 V Cond.
1—2000 KW 600 V Cond.
1—1500 KW 2300 V Cond.
2—1250 KW 2300 V Cond.
1—1000 KW 2300 V Non-C.
2—1000 KW 440 V Cond.
1— 625 KW 2300 V Cond.
1— 600 KW 240 V Cond.
1— 500 KW 600 V Cond.
1— 500 KW 2300 V Cond.
1— 500 KW 480 V Extrac.
1— 250 KW 2300 V Non-C.
1— 250 KW 240 V Non-C.

TURBO-GENERATORS (Continued)

1— 150 KW 2300 V Non-C.
1— 125 KW 600 V Extrac.
2— 125 KW 220 V Non-C.
1— 100 KW 600 V Non-C.
1— 50 KW 220 V Non-C.
1— 250 HP Turbine Gears
1— 375 HP Turbine Gears

ENGINE GENERATORS

2—400 KW 250 V. DC Vert. Uni.
1—375 KW 2300 V. Uniflow
1—168 KW 600 V.
1—168 KW 240 V.
1—168 KW 220 V. Uniflow
2— 96 KW 220 V. Uniflow

BOILERS

2—30,000# 425#
1—1030 HP 225#
1— 500 HP 400#
1— 300 HP 200#
1— 220 HP 160#
1— 200 HP 175#
6— 200 HP Sterling 160#
2— 190 HP 160# NEW
2— 510 HP Sterling 160#

AIR COMPRESSORS

1—6000 CFM 50# Motor
2—5600 CFM 50# Motor
1—4500 CFM 100# Motor
1—1300 CFM 100# Motor
1—6000 CFM 5.1# NEW
1—5000 CFM 10# Rotary Type Motor

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

The Buyers Must Be Satisfied—Always

COMPRESSORS

New or Re-Built—Sale or Rent

- BARGAIN -

DIESEL PORTABLES

210' and 315"

SKID OR MOUNTED Electric Starters

AMERICAN AIR COMPRESSOR CORP.

4704 Dell Ave., No. Bergen, N. J.

N. Y. Phone Chi 4-7665—N. J. Phone Un 5-4848

45 Years of Service

DIESEL-GENERATORS

5 KW. TO 1000 KW.

NEW-USED RECONDITIONED

J. PARKER THOMPSON CO., INC.

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MURRAY HILL 7-6547

TRANSFORMERS

1 KVA up to 200 KVA in stock

ARROW TRANSFORMER CO., INC.

1932 E. Westmoreland St. Phila. 34, Pa.

Phone Ga. 5-0488

ASME BOILERS Nat'l Bd.

2—104 HP sectional steel header cross drum Springfield, 10' settings, oil fired.
2—25,000# (normal rating) Stirling's pulverizers, 425#.
2—400 HP sectional header, underfeed stokers.
1—300 12' settings, 7 years old, stack & breeching for these 3 units.

H. P. BREARLEY

3423-91st Street Jackson Heights, N. Y.

FOR SALE

CROCKER WHEELER MOTOR

300 HP, 230 Volts D.C., 500 RPM, Type CCM, Size 108DA, complete with Starting Control Panel.

ELECTRIC APPARATUS REPAIR CO.

1400 N. 6th St. Philadelphia 22, Pa.

IN THE PAST THIRTY DAYS

WE HAVE SOLD

FIVE DIESEL GENERATOR SETS . . . . . .

totalling 8,000 H.P. to a Midwestern Utility.

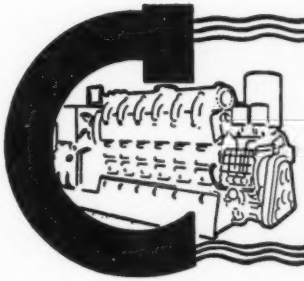
These units are being installed by us and will carry our usual guarantee and performance bond.

●

Six more sets are now available as follows:

1600 H.P. General Motors, Model 16-278-A, 16 cylinder Diesel Engine, bore 8¾", stroke 10½", RPM-720, *direct connected to—*

New 1250 KVA Ideal Elec. and Mfg. Co. Generator, 2400 volts, 3 phase, 60 cycle A. C. @ .8 p.f. Belted Exciter —New 10 K. W. Ideal Elec. & Mfg. Co.



F. L. CUSAC *and Associates Inc.*

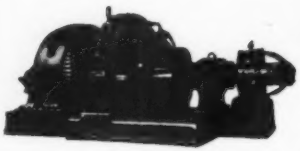
DIESELS

WEBSTER 9-4180

BOARD of TRADE BLDG. — — CHICAGO

REBUILT BY CHICAGO ELECTRIC

Fine Items From One of The Nation's Largest Stocks Of Motor Generator Sets' Check These Units For Service, Economy and Prompt Delivery



Special Offering

MOTOR GENERATOR SETS

1000 KW generator, General Electric type MPC, compound interpole, 275 volts, 514 RPM, direct connected to, 1120 KVA synchronous motor, General Electric, type TS, 3 phase, 60 cycle, 4600 volt, 514 RPM, on fabricated steel sub-base. Complete.

500 KW generator General Electric, type MPC, compound interpole, 250 volts, 720 RPM, direct connected to, 710 HP synchronous motor, General Electric, Type ATI 3 phase, 60 cycle, 440 volts, 720 RPM, 3 bearing unit, on fab. steel sub-base.

TWO COMPLETE VARIABLE VOLTAGE DRIVES

Motor Generator Set—

200 KW DC generator, General Electric, type MPC 250 volts, 800 amps, 1200 RPM, direct connected to, 300 HP synchronous motor, General Electric, type TS, 3 phase, 60 cycle, 440 volts, .8 P.F. 1200 RPM.

D.C. Motor—

250 HP General Electric, type MPC, form A, 245 volts, 730/975 RPM. Complete Starting and Control Panels.

MOTOR-GENERATOR SETS

KW	Make	Volts AC	Volts DC
1250	Allis Ch.	3/60/4000	600
1000	G. E.	3/60/4000/2300	250/275
500	G. E.	3/60/440	250
500	Westg.	3/60/2300	250
450	G. E.	3/60/2300	137.5/275
450	G. E.	3/60/2300/440	125/250
200	Cr. Whlr.	3/60/2300	125
200	G. E.	3/60/440	250
	Paper Drives		
150	Allis Ch.	3/60/220	125
90	G. E.	3/60/2300/440	90
75	G. E.	3/60/2300/440	250
75	G. E.	3/60/2300/400	125
75	Star	3/60/440-20	250
75	Westg.	3/60/2300 gen.	250 motor
60	Allis Ch.	3/60/2300	110
40	Cr. Whlr.	3/60/220	125
40	Reliance	3/60/440	250
40	Chandson.	3/60/220	40
10	Hertner	3/60/220	90/108
6	G. E.	3/60/440	230
25	Bogue	3/60/440	125

Low Voltage M. G. Sets

Amp.	Make	DC volts	AC volts
5000	Ideal	9/18	3/60/220/440
1500	Chandeysson	40	3/60/220/440
1500	G. E.	90	3/60/2300/440
1000	Chandeysson	40	3/60/220/440
1000	G. E.	40	3/60/220
323	Columbia	45	3/60/440
65/26	Hertner	90/108	3/60/440

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	Speed
500	G. E.	K-559DZ	440	3600
400	Allis Ch.	Spf.	2300	900
200	G. E.	K-6334S	440	1200
200	Westg.	CS-32B	440	720
125	G. E. Tefc	K-6326S	440	1200
125	Wtg.	CS	440	435
125	Allis Ch.	AR	440	1800
100	Allis Ch.	AR	440	3600
75/125	Wtg.	CS	440	345/435
100	Allis Ch	AR	440	514
75	G. E.	I-K	440	720

SLIPRING MOTORS

HP	Make	Type	Volts	Speed
3000	G. E.	I-M	2300	120
500	Ideal	AV	2300/4000	1800
350	Wtg.	CW-1214	2300	450
600	G. E.	I-M	440	352
300	G. E.	I-E-15A	2300	1800
100	Allis Ch.		220	720
75	G. E.	I-M	440	1750
75	G. E.	I-M	440	514
60	Wtg.	CW-762C	2300	900

SYNCHRONOUS MOTORS

HP	Make	Power F	Volts	Speed
1500	G. E.	ATI .85	4150	514
600	G. E.	TRE	2300	450
1000	Wtg.	.80	2300	900
450	El. Mach.	100	440	240
250	Allis Ch.	.80	2300	720
200	Allis Ch.	100	2300/440	360
100	G. E.	ATB 100	2300	900

FREQUENCY CHANGER

1000 KW, G.E. type ATI, 300 RPM, 25 cycle end is 9000 volts, 60 cycle end is 4150/2400 volts.

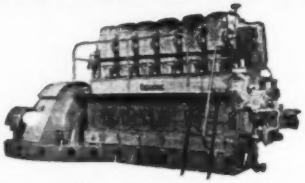
Remember! This Is Only A Partial Listing From Our Large Quality Stocks. We can Furnish You With Almost Any Item in the Electrical Power Equipment Field . . . . And Then Some

CHICAGO ELECTRIC COMPANY

1320 WEST CERMAK ROAD CHICAGO 8, ILL. CANAL 2900

NEW ENTERPRISE DIESELS

450 HP
450 RPM
Model DSG-6



375 KVA
300 KW
AC STD VOLTAGES

Qu.	HP	Model	RPM	KVA	KW	GEN.	Ph.	Cycle	Volts
2	1600	General Motors 16-278A	720	1250	1250	General Elec	3	60	2300
2	1600	General Motors 16-278A	720	1250	1000	Elliott	3	60	2400/4160
1	500	Fairbanks Morse Type Y	257	418	415	Fairbanks Morse	3	60	2400
3	450	Enterprise DSG-6	450	...	250	Elliott	...	DC	120/240
1	300	Buckeye Model E	400	250	200	Elec. Mchnry.	3	60	240
1	225	Buckeye Model E	400	187	150	Ideal	3	60	240
9	125	General Motors 6016-E	1200/1000	75/62.5	60/50	General Elec.	3	60/50	127/220-230/400
1	100	International UD-18	1200	62.5	50	Westinghouse	3	60	240
2	82	International UD-14	1200/1000	37.5/32.5	30/25	Elec. Mchnry.	3	60/50	127/220-230/400
8	36/30	International UD-9	1200/1000	23/18.75	18.75/15	Elec. Mchnry.	3	60/50	240/440/127-220
1	79	Caterpillar D6600	1200	37.5	30	Ideal	3	60	220

One plant Consisting of Three Units, i.e. 65, 150, and 200 KW.
New units (all other units used).

Diesel Motors

WE HELP TO LIGHT AND POWER THE WORLD

PORT WASHINGTON, L. I., N. Y. CORPORATION TEL: PORT WASHINGTON 7-2000

BOILER Special

NEW 1947

Used 6 Months

1—300 H.P. Edgemoor Water Tube Cross Drum Box Header, 225 Lb. W.P. A.S.M.E. Code . . . McCleave-Brooks Stoker, Diamond Soot Blowers, Forced Draft Fan, Boiler Feed Pump, Trimmings, Steel Work . . . Replacement Value $20,000.00—

SPECIAL PRICE FOR QUICK SALE, F.O.B. Phila., $7500.00

Everything from a Pulley to a Powerhouse

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

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FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

50,000 lb. Integral Furnace 400 lb. B & W boiler superheater air heater pulverizer fans accessories
2500 KW 2400 volt GE Cond. turbine unit
1500 KW 480 volt GE NonCond Turbine set.
283 KVA 240 volt Chuse Uniflow engine set.
200 KVA 480 volt Ridgway 4 valve engine set.
200 KW G. E. M. G. Set 2200 AC 250 DC
50 KW G. E. M. G. Set 220/440 AC 250 DC.

HOWARD B. JOHNSON & ASSOCIATES
53 W. Jackson Blvd. Chicago 4, Ill.

BOILERS

10 to 1000 H.P.

NEW-USED RECONDITIONED

Steam, Gas and Electric Power Equipment

J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

MOTOR GENERATORS

500 KW G.E. SYN. 250 V. 440/2300/4000 A.C. 3 PH. 60 CY. 900 RPM.

500 KW G.E. SYN. 600 V. 2300/4000 A.C. 3 PH. 60 CY. 900 RPM.

400 KW WEST. SYN. 600 V. 2300/4000 A.C. 3 PH. 60 CY. 720 RPM.

300 KW G.E. SYN. 250 V. 2300/4600 V. A.C. 3 PH. 60 CY. 1200 RPM.

150 KW G.E. SYN. 250 V. 2300/4000 V. A.C. 3 PH. 60 CY. 1200 RPM.

SYNCH. CONVERTER

300 KW G.E. 600 V. D.C. 6 PH. 60 CY. 1200 RPM 2300/4000 V. TRANSFORMERS

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK COMPANY

502 Grant Building, Pittsburgh, Pa.

TURBO-GENERATORS

200 KW. TO 5000 KW.

NEW-USED

RECONDITIONED

J. PARKER THOMPSON CO., INC

507 FIFTH AVE., NEW YORK 17, N. Y.

MURRAY HILL 7-6547

TRANSFORMERS

FOR SALE

3— 3 KVA W-H 13200-120/240
12— 5 KVA W-H 13200-120/240
4— 10 KVA W-H 13200-120/240
1— 15 KVA W-H 13200-120/240
3— 25 KVA W-H 13200-120/240
3— 25 KVA Mol 13200-120/240
10—37½ KVA W-H 13200-120/240
2— 25 KVA W-H 13200-2400
2—37½ KVA Mol 13200-2400/4160Y
3— 75 KVA W-H 13200-120/240
3— 75 KVA G-E 13200-120/240
1— 75 KVA Mol 13200-2400
1— 100 KVA W-H 13200-2400
10— 1½ KVA Wag 7200-120/240 "REA"
2— 5 KVA G-E 4800-120/240
4— 5 KVA W-H 2400/4800-120/240
4— 7½ KVA W-H 4800/8320Y-120/240
1— 25 KVA Mol 2400/4800-120/240
3— 50 KVA W-H 4800/8320Y-120/240
3— 50 KVA G-E 26400-2300/4000Y
3— 50 KVA G-E 33000-2400/4160Y
3— 100 KVA G-E 33000-2400/4160Y
3— 200 KVA Pitts 26400-2300/4000Y

TRANSFORMERS

WANTED

Rewind and repair service on all makes of transformers.

THE ELECTRIC SERVICE CO.

Cincinnati 27, Ohio

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

PROMPT SHIPMENT—PARTIAL LISTING

SLIP RING MOTORS—3 Ph., 60 Cy.

Qu.	H.P.	Speed	Volts	Make	Type
6	7½	515	550	G.E.	MTC-5201
1	7½	575	220	G.E.	MT-522
2	10	1140	440	West.	HF-7A
2	10	570	220	G.E.	HI-11
2	11‡	810	550	G.E.	ITC-5008
2	15	1160	440	West.	CW-464C
2	15	570	220	West.	CW-646
1	18	680	440	West.	NW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	850	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	1130	440	G.E.	MT-326
1	30	865	440	West.	CW-646
1	30	850	440	G.E.	MT-352
1	30	675	440	G.E.	MT-336
2	35	600	440	F-M	HV-H16A
2	40	865	2200	Al.-Ch.	ARY-223C
1	40	560	440	G.E.	MT-346
2	50	1150	440	G.E.	M-536
1	50	869	440	West.	HF-12A
1	50	570	440	G.E.	MT-552
5	52‡	550	220	G.E.	IQC-5013***
1	60	685	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW
1	75	720	550	G.E.	MT-556
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
2	250**	296	220/ 380††	West	CW-20-53-15
3	300	900	140	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
2	300**	360	440	West.	CW-20-53-15
2	350	880	2200	G.E.	IM-17A
1	400	505	550	West.	CW
1	650**	360	440	G.E.	MT-442Y
1	700	735	4000‡‡	West.	CW

All 220 volt motors can be reconnected for 440 volts.
‡ Intermittent rating. *** 2 phase.
** New. †† 50 Cycle. ‡‡ 25 Cycle.

230 Volt Constant Speed D.C. Motors

On.	H.P.	Speed	Make	Type
22	2	850	West.	SK-20
20	3	1150	West.	SK-20
10	3	850	Reliance	Y-23T
25	3½	850	West.	SK-30
3	7½	1750/1310	West.	SK-43
2	7½	1150	G.E.	CDM-6a
3	7½	850	G.E.	CD-75
10	10**	1750	Kimble	BA-324
5	10**	1150	Al.-Ch.	EB-80
1	10	850	West.	SK-83
10	13½**	600	West.	SK-93
3	15	1750	G.E.	CD-75
5	15	825	West.	SK-90
1	20	1750	L.A.	ONA-L851
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-80
11	20	750	West.	SK-1101
17	25	825	West.	SK-120
2	30	1100	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	650	G.E.	RC-16
2	60	1750–1310	West.	SK-143
3	75	850	West.	SK-160
1	150	700	Al.-Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D.C. MOTORS

10	1½	500/200	G.E.	CD-65
1	2	225/900	Reliance	7ST
1	5	450/1800	G.E.	CD-83
2	6	450/1800	G.E.	RF-9
6	5 7½	600/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
1	12½	280/840	West.	SK-130
10	12½**	600	West.	SK-93
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20-25	400/1600	Reliance	T-230-T
1	20-25	300/1200	West.	SK-153
1	25	400/1600	G.E.	RF-13
1	25	500/1500	G.E.	RF-12
1	23/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-163
1	30/40**	400/1600	G.E.	CD-1236
1	35	500/1500	West.	SK-143
1	40/50	400/1600	Al.-Ch.	ED-147
1	75	500/1500	Cr.-Wh.	CCM
1	75	375/750	Cr.-Wh.	CMC-125H
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al.-Ch.	
1	100	320/960	West.	SK-200
1	175	230/500	West.	SK-220
2	375	350/500	G.E.	MPC

** New.

VARIABLE VOLTAGE DRIVES

40 HP. Reliance, Variable Voltage Drives, each Consisting of:
1—40 KW 230 Volt. Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.
Totally Enclosed Fan Cooled, Ball Bearing

On.	H.P.	RPM	Volts	Make	Type & Frame
2	¼	1750	220	R&M (TE)	L-184
1	½	1725	440	G.E.	K-63
4	1	1140	220	Howell	A-204
4	1.5	1150	220	L.A. (TE)	IS-225
5	1.5	1140	440	West.	CS-225
1	2	1735	220	G.E.	K-224
4	2	1140	220	L.A.	JS-225Y
1	2	1100	440	West.	CS-225
1	3	3450	220	Howell	K-224
2	3	1160	440	L.A.	JS-284
1	5	3480	220	G.E.	K-225
2	5	1750	440	L.A.	JA-254
10	5	1730	440	G.E.	K-254
1	5	1720	440	Century	SCH-254
2	5	1165	440	L.A.	JA-284
1	7.5	1740	440	G.E.	K-284
1	7.5	1735	220	G.E.	KF-284
1	10	3480	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	10**	880	220	West.	CS-365-EXPF
1	15	1745	440	West.	CS-326
1	15	1175	440	L.A.	JA-365
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504

Splashproof, Ball Bearing

1	2	1735	440	G.E.	K-224
1	3	1160	440	L.A.	FS-254
23	5	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
4	15	1150	440	L.A.	FX-365
3	30	3520	440	L.A.	FX-3658
2	40	1175	220	G.E.	K-445
3	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	125	1770	440	L.A.	FX-1078Y
1	150	1775	440	L.A.	FX-1168
3	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-6335
1	200	885	440	L.A.	FS-1378

Open Type Motors

On.	H.P.	Speed	Volts	Make	Type
5	2	170	440	G.E.	KT-926
4	2	1160	440	West.	CS-93C
1	2	690	440	G.E.	KT-944
10	5	1740	440	West.	CS-232C
1	7½	3475	440	West.	CS [illegible]
1	7½	1750	440	West.	CS-250C
3	7½	1165	440	G.E.	KT-952
2	7½	870	440	West.	CS-370C
5	10**	1760	440	L.A.	OGA-324
1	10**	1750	440	West.	CSP-324
3	10	1160	440	West.	CS-370C
1	10	865	440	G.E.	KT-502
1	15	3485	220	Reliance	AA-B3247
5	15**	1735	440	Century	SC326
1	15	1200	220	G.E.	KT-802
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RPI-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KF-512
2	20	900	220	G.E.	FTR-522
1	25	1800	220	G.E.	KT-312
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	SCRB-356***
2	25	575	440	G.E.	KT-542
1	30	1160	440	West.	CS-644
1	30	870	440	West.	CS-646
1	40**	3545	220	G.E.	KF-4048
3	40	1750	440	West.	CS-583C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	RP5-405
1	50	850	220	West.	CCL
2	60**	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-548
1	75	1160	440	West.	CS-662C
1	75	870	220	West.	CS-766A
2	75	885	2300	G.E.	KT-352
1	100	890	220	West.	C
1	100	580	2200	G.E.	TK-15A
2	100	500	2200	West.	CS-930
1	100	495	2200	Al.-Ch.	AN
2	125	435	440	Al.-Ch.	AR
2	125	400	2300	G.E.	T-17-FR
1	200	580	5501‡	G.E.	KT-5668
1	500	1200	440	G.E.	KTH-587
1	700	1800	2300/4000	West.	CS-4-39D-12

All 220 volt motors can be reconnected for 440 volts.
** New. *** 2 Phase.
‡‡ Reconnectable for 440 volts.

CRANE, MILL TYPE, 230 V. D.C. MOTORS

On.	H.P.	Speed	Make	Type
2 (115 v.)	3½	700	G.E.	CO-1803
2	5½	760	West.	MCB-20
1	6½	680	West.	K-3
1 (new)	6/7	1050/900	G.E.	K-2
1 (new)	10	650	G.E.	MD-403-BE
1 (new)	20/25	975/875	West.	K-5
1 (new)	20/25	515/460	West.	K-6
3	25	890	Diehl	TE
2	27½	535	West.	K-7
2	35	750	G.E.	CO-1828
3 (new)	35	600	West.	CK-9
1	50	750	G.E.	CO-1829A
1	50	600	West.	CK-9
5 (new)	50	525	G.E.	COM-1830AE
4	50	525	G.E.	CO-1830
1	50	470	G.E.	CO-2007
2 (new)	60	550	G.E.	COM-1831 AE

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment Is Located In Our Cleveland Warehouse. We Have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVE. CLEVELAND 14, OHIO

MOTORS • GENERATORS • TRANSFORMERS

MOTORS
3 PHASE—25 CYCLE—220/440 VOLTS

H.P.	Make	Type	Frame	RPM
50	Fairbanks Morse	H16B	Ball Bearing	750
75	Fairbanks Morse	H16C	B.B. Slipring	750
75	Gen. Elect.	IK	2200 volt	750
75	Gen. Elect.	IK		1500
100	Allis Chalmers			1450
150	Gen. Elect.	IK-17		385
150	Gen. Elect.	IK-16		480
150	Gen. Elect.	IM-16	Slip Ring	480
150	Allis Chalmers			1450
150	Gen. Elect.	KT	557	1455
400	Gen. Elect.	IM 17A	Slip Ring	730
500	Gen. Elect	IK		485
600	Gen. Elect.	MT	Slip Ring	490
600	Westinghouse	CS		490

NEW TRANSFORMERS

6—50 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—75 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—100 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—100 KVA Niagara O.I.S.C. 2400/120/240 1 Phase 60 cycle with taps.
3—150 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
6—200 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.

REBUILT TRANSFORMERS

Qu.	KVA	Make	Cycle	Voltage
3	15	Wagner	25	4400/240/480
3	50	Pitts.	25	11000/2300
2	50	Kuhlman	25	11500/2300/230/460
1	50	Kuhlman	25	11500/115/230
2	50	G. E.	60	2400/120/2400
1	100	G. E.	25	4600/230/460
3	400	Pitts.	25	12000/110

FREQUENCY CHANGERS
All Sizes in Stock, 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 and any other high cycle if desired.

HORIZONTAL & DUPLEX
Compressor & Vacuum Pumps after Coolers, Filters

25 CYCLE MOTORS

1—1270 HP. Gen. Elect. Synchronous Motor Type A.T.I. 9/25/2200 Volts 150 RPM.
1—1900 HP. Gen. Elect. Syncuronous Motor Type A.T.I. 3/25/2200 Volts 150 RPM.

MOTOR GENERATOR SETS

2—350 KW General Electric Sets 250 Volts D.C. driven by 500 HP. 3 Phase 25 Cycle motors —Will rewind for 60 Cycle operation.

ROTARY CONVERTERS

1—2000 KW Westinghouse Booster type Rotary Converter 230 Volt D.C.—3 to 6 Phase, 25 Cycle, 4000 Volt Transformer.
2—2500 KW Gen. Elect. Synchronous Converters, 270 Volt D.C.—Transformer 3 Phase, 25 Cycle, 11,000 volts.
2—3500 KW Gen. Elect. Synchronous Converters, 270 Volt D.C.—Transformers 3 Phase, 25 Cycle, 11,000 volts.

COMPENSATORS

1—40 HP Gen Elect New Type CR. 1034-K1 3/60/220 Volts.
1—50 HP Gen Elect New Type CR 1034-K1 3/60/220 Volts.
2—75 HP Gen Elect New Type CR. 1034-K1 3/60/220 Volts.

NEW MOTORS
300 New Gen. Elect. & Westinghouse Motors in stock from 1 to 100 H.P.

75 KW. FREQUENCY CHANGER
75 KW. Gen. Electric Frequency Changer. 3 phase 120 Cycle 220/440 Volts—direct driven by 60 HP. Motor 3/60/220/440 volts.

MOTORS

1—75 HP. Fynn-Weichel Synn. 3/60/440/1200 RPM.
1—100 Gen. Elect. Slipring Type I Form M., 3/60/440/900 RPM.
1—100 HP. Gen. Elect. Type K (New Motor) 3/60/440/1800 RPM.
1—100 HP Westinghouse Slipring Type CW, 3/60/440/435 RPM.
1—100 HP. West. Slipring Type CW 3/60/440/1200 RPM.
1—100 HP. Gen. Elect. Slipring 3/60/440/1200 RPM.
1—200 Gen. Elect. Type KT. 572 3/60/440/600 RPM.
1—200 HP. Gen. Elect. Slipring Type I Form M. 3/25/440/500 RPM.
1—500 HP. Allis Ch. Slipring 3/60/2200/514 RPM.
1—500 HP. Gen. Elect. Type I Form K. 3/25/440/485 RPM.
1—600 HP. West. Motor Type CS, 3/25/550/490 RPM.
1—600 HP. Gen. Elect. Slipring Type MT. 3/25/550/490 RPM.

VARIABLE SPEED MOTORS
2—300/150 HP. General Electric Motors Type BTA.—3 Phase 60 cycle 440 volts 580/280 RPM with controls.

3 PHASE 550 VOLTS 25 CYCLE MOTORS
Write for our stock list of approximately 500—3/25/550 Voltmotors

ERIE ELECTRIC CO., INC.
124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

TURBO GENERATORS

TURBINE OF THE MONTH
1—5000 KW. 6250 KVA. Gen. Elec. 3600 RPM 175/200 lbs. I.S.P., 100° SH. Condensing 3 ph 60 cyc., 2300/4000 volts surface condenser and all auxiliaries.

1—2000 KW G.E. 6600v, 3 ph., 60 cy. with 175 lb. cond. turbine and dir. conn. exciter.
1—1500 KW Westg. 400#, 700°F, condensing 3 ph, 60 cy. 2400 V. Surface condenser.
1—450 KW Whse 250 lbs. I.S.P. Surface Condensers—Auxiliaries—3 phase, 60 Cycle, 400 Volts. Direct connected Exciter Equipment built 1944.
2—1250 KW G.E. 2300v, 3 ph. 60 cy. with 175 lbs. condensing turbine
1—1250 KW Al Ch. 2300v, 3 ph., 60 cy. with 200 lb. condensing turbine surface condenser.
1—1000 KW G.E. 2300/4150v, 3 ph., 60 cy. with 135/150 lb. condensing turbine.
1—500 KW G.E. 480v, 3 ph., 60 cy. dir. conn. exciter with 80/100 lbs. I.S.P. 10/15 lbs. B.P., non-condensing turbine.
2—500 KW G.E. 2400 v, 3 ph., 60 cy. dir. conn. exciter, 175 lbs. I.S.P. 10/15 lbs. B.P. non-cond.

BELYEA COMPANY INC.
43 HOWELL ST. JERSEY CITY 6, N. J.
Phone—Journal Square 2-3334
ALSO N. Y. CITY LINE—RECTOR 2-7150

AVAILABLE FOR IMMEDIATE DELIVERY PERFECT CONDITION

1—750 KVA UNAFLOW ENGINE GENERATOR SET, right hand, consisting of:

1—G. E. 750 KVA Generator ATB—150 RPM—Form E, 600 KW, 3 phase, 60 cycles, 2300 volts, .8 PF.
1—Filer & Stowell 26 x 36 Non condensing Unaflow Engine, 175# steam pressure, 10# back pressure.
1—G. E. Belted 20 KW-125V, 725 RPM Exciter.
1—Switchboard for generator control.
STILL SET UP AS OPERATED.

Also—large assortment Motors—(chiefly GE Triclad), 3 phase, 60 cycle, 220-440V, including unused 3-60 HP TESC 3500 RPM.

Send all inquiries to:
CONSOLIDATED PRODUCTS CO., INC.
P. O. Box 299 Waverly, Iowa

FOR SALE
MOTOR GENERATOR SET
500 KW West. Syn. M. G. Set 250 v.—2200/4000/3/60 factory built with panels.
MOORHEAD ELECTRICAL MACHINERY CO.
Mayflower 7900 Pittsburgh 19, Pa.

STEEL STORAGE TANKS
6—74,000 & 35,000 Bbl. Vertical
2—10,000 & 3—3,000 Bbl. Vertical
6—10,000 & 3—20,000 Gal. Horizontal
DARIEN CORP.,
60 E. 42nd St., N. Y., N Y

DIESEL-GENERATORS
5 KW TO 1000 KW.
NEW-USED
RECONDITIONED
J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK 17, N. Y.
MURRAY HILL 7-6547

"BREW, WOLTMAN OFFERS"

TURBINE UNITS

1— 9375 KVA Cond. 50 cy. 13800 V. 600-lb. 825 deg. FTT. With surface condenser & boiler. NEW.
1—12500 KVA West. Cond. 25 cy. 600 V. 200-lb.
1— 5000 KVA G.E. Non-C. 60 cy. 13200 V. 800-lb.
1— 3750 KVA West. Cond. 60 cy. 2300 V. 200-lb.
1— 3125 KVA G.E. Cond. 60 cy. 2300 V. 200-lb.
1— 2500 KVA G.E. Cond. 60 cy. 2300 V. 200-lb.
1— 1563 KVA G.E. Extraction 60 cy. 2300 V. 400-lb. extraction 160-lb. Cond.
1— 1250 KVA DeLaval Non-C. 60 cy. 2300 V. 250-lb.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 200-lb.
1— 1250 KVA G.E. Non-C. 60 cy. 480 V. 400-lb.
1— 1250 KVA West. Non-C. 60 cy. 2300 V. 275-lb.
1— 937 KVA G.E. Cond. extraction 60 cy. 480 V. 375-lb.
2— 625 KVA G.E. Cond. extraction 60 cy. 480 V. 375-lb.
1— 625 KVA G.E. Non-C. 60 cy. 240 V. 175-lb.
1— 600 KVA Allis Cond. 60 cy. 480 V. 150-lb.

WATER TUBE BOILERS

2— 600 HP B. & W. 350-lb. Stokers
1— 519 HP Titusville 200-lb. Stoker
2— 500 HP B. & W. 200-lb. Stokers
1— 506 HP Union City 400 lb. Pulverizer
1— 418 HP Comb. Engr. 400-lb. Stoker
1— 180 HP Frost 200-lb. return tubular

STEAM ENGINE UNITS—60 Cy.

1— 1250 KVA Nordberg Uniflow. 480 V.
1— 459 KVA Ames Uniflow. 2300 V.
1— 400 KVA Skinner Uniflow. 480 V.
1— 312 KVA Skinner Uniflow.
1— 156 KVA Ames Vert. Uniflow. 240 V.
1— 150 KVA Ames Uniflow. 220 V.
1— 125 KVA Ames Uniflow. 2300 V.

D. C. STEAM ENGINE UNITS

2— 750 KW Skinner Uniflow 250 V.
1— 300 KW Skinner Uniflow 275 V.
1— 275 KW Ames Vertical Uniflow 250 V.
1— 200 KW Skinner Uniflow 250 V.
1— 200 KW Skinner Uniflow 125 V.
1— 100 KW Skinner Uniflow 230 V. 3-wire
1— 75 KW Ames Uniflow 125 V.

DIESEL ENGINE UNITS

2— 1600 HP Fair. Morse 60 cy. 2300 V. NEW gen.
1— 720 HP Amer. Loco. 240 V. DC
1— 625 HP Worth. 240 V. 60 cy. gen.
1— 600 HP Fair. Morse 2400 V. 60 cy.
1— 400 HP DeLaVergne 2400 V. 60 cy.
2— 375 HP Worth. 240 V. 60 cy. gen.
2— 240 HP Fair. Morse 2400 V. 60 cy.
1— 150 HP Gen. Motors 3-278A-60-3-480
2— 135 HP Murphy 240 V. 60 cy.

SYNCHRONOUS MOTORS—60 Cy.

2— 3000 HP G. E. 1700 V. 257 RPM
1— 2800 HP E. M. 2200 V. 225 RPM
1— 880 HP G. E. 6600 V. 514 RPM
2— 500 HP E. M. 2200 V. 514 RPM
3— 400 HP E. M. 440 V. 600 RPM
1— 350 HP G. E. 4800 V. 225 RPM
1— 300 HP G. E. 2300 V. 600 RPM
1— 300 HP West. 2300 V. 900 RPM
4— 150 HP West. 2200 V. 400 RPM
1— 150 HP G. E. 2300 V. 600 RPM
1— 150 HP G. E. 4160 V. 600 RPM
2— 125 HP G. E. 2300 V. 600 RPM
1— 100 HP G. E. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.

1— 8000 HP Cr. Wh. 2200 V. 895 RPM
1— 7200 HP S/R 11000 V. 750 RPM 3 ph. 25 cy.
1— 1200 HP Al. Ch. S/R 2200 V. 440 RPM
1— 1000 HP G. E. S/R 2200 V. 514 RPM
3— 350 HP Elliott S/C 2300 V. 900 RPM
1— 300 HP West. S/R 2200 V. 1770 RPM
1— 250 HP G. E. S/R 2200 V. 1800 RPM
1— 200 HP E. M. S/C 480 V. 1800 RPM
1— 200 HP G. E. S/R 2200 V. 435 RPM
1— 150 HP Cr. Wh. S/C 440 V. 1800 RPM
1— 150 HP Al. Ch. S/C 440 V. 1200 RPM

MOTOR GENERATOR SETS

1— 1500 KW Al. Ch. 600 V. DC 60 cy.
2— 1000 KW Gen. Elec. 600 V. DC 60 cy.
1— 1000 KW Gen. Elec. 250 V. DC 60 cy.
1— 500 KW Gen. Elec. 250 V. DC 60 cy.
1— 300 KW West. 250/125 V. DC 60 cy.
1— 200 KW Gen. Elec. 60 V. DC 60 cy.
1— 75 KW West. 125 V. DC 60 cy.
1— 75 KW Ridgway 115 V. DC 60 cy.
1— 75 KW Star 240 V. DC 60 cy.
1— 18 KW West. 60 V. DC 60 cy.

ROTARIES—60 Cy.

1— 2929/3705 KW Gen. Elec. 225/285 V.
1— 2025/2565 KW Gen. Elec. 225/285 V.
1— 2000 KW Allis Chalmers 600 V.
1— 1500 KW Westinghouse 600 V.
2— 1500 KW Westinghouse 270 V.
1— 1000 KW General Electric 600 V.
1— 750 KW Westinghouse 275 V.
1— 500 KW Allis Chalmers 600 V.
1— 500 KW General Electric 275 V.

FREQUENCY CHANGERS

1— 6250 KVA G. E. 50/60 cy. 600 RPM
2— 3000 KVA West. 25/60 cy. 300 RPM
1— 2500 KVA G. E. 25/60 cy. 300 RPM
2— 1000 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA Al. Ch. 25/60 cy. 300 RPM

TRANSFORMERS—60 Cy.

1— 7500 KVA Al. Ch. 33000-13800 V. 3 ph.
1— 667 KVA Pitts. 33000-11000 V.
1— 50 KVA G. E. 33000-2300 V.
3— 75 KVA Moloney 33000-2300/6900 V.
1— 3750 KVA West. 26400/13200—2400 V.
1— 8000 KVA Penn Auto 26400-13200/2400 V. 3 ph.
1— 450 KVA Al. Ch. 25410/44000-13280/23000 Y
1— 1667 KVA Wagner 2300-575 V. 25 cy.
2— 4000 KVA Penn. Furnace 22000-228 V. 3 ph.
1— 3000 KVA Al. Ch. Furnace 13200-200 V.
1— 200 KVA G. E. 11500-220/110 V.
1— 200 KVA Moloney 11000-2300 V.
3— 167 KVA G. E. 7200/12400 Y-240/480 V.
1— 1500 KVA West. Auto 4000-2300 V. 3 ph.
1— 100 KVA G. E. 2300-575 V. 3 ph.
3— 250 KVA Al. Ch. 2300-460 V.
1— 20 KVA West. 2200-575/287½ V.
1— 7½ KVA G. E. 600-120/240 V.
12— 15 KVA Standard 450-117 Delta
1— 27½ KVA G. E. 440-220/110 V.

OIL CIRCUIT BREAKERS

2— 800 A. 87 KV Am. Brown Bov. Outdoor
1— 400 A. 37 KV We t. Gil Outdoor
2— 400 A. 25 KV G.E. FK0136 Outdoor
2— 1000 A. 23 KV Kelman CB76 Outdoor
1— 600 A. 15 KV G. E. FHK0139BS Outdoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street — New York City 7 — New York

DIESEL UNITS

2—450 HP Fairbanks Morse 32E, 6 cyl. 300 RPM, 300 KW. 3/60/2300. New 1942.

1—600 HP Fairbanks Morse Model 33, 4 cyl. 400 KW, 257 RPM, 3/60/2400. Complete. Excellent.

2—450 HP Chic. Pneu. 257 RPM. 4 cyc. 300 KW, 3/60/2300. Westinghouse gen. Excellent.

MISSISSIPPI VALLEY EQUIPMENT CO.

507 Locust St. — St. Louis 1, Mo.

BOILERS

10 to 1000 H.P.

NEW-USED
RECONDITIONED

Steam, Gas and Electric Power Equipment

J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

TURBO GENERATORS

1—500 K.W., 3 phase, 60 cycle, General Electric non-condensing.
500 KW., 3 phase, 60 cycle, 440 volt Gen. Elec. #39937 with surface condenser, evactor, and switchboard.
750 KW. Gen. Elec., 150 lbs. steam, 10-20 lbs. extraction.

MOTOR GENERATORS

100 KW., 125 volt Gen. Elec. to a 150 HP., 3 phase motor.
80 KW., 80 volt Burke with synch. motor and panels.
50 KW., 250 volt Westgh. to 3 phase synch. motor.

TRANSFORMERS

2—500 KVA, Pittsburgh, 33000 x 13200/6600.
3—400 KVA, General Electric, 13200 x 120/240.
2—150 KVA, Pittsburg 2300 x 230/460 volt.
2—150 KVA, Pittsburgh 2400 x 120/240 volt.
Over 100 NEW Gen. Elec. up to 75 KVA, 450 x 120 volt.

DC ENGINE GENERATOR

150 KW., 125 volt Crocker Wheeler to a 4 cylinder vertical Ames engine.

MOTORS

Large stock AC & DC motors.

CAPACITORS

50—15 KVA, 220 volt, 3 phase, new, General Electric.

A. C. GENERATORS TO GASOLINE ENGINES

3—25 KVA, 120 volt, 1 phase, 60 cycle, 900 rpm, Westinghouse, with exciters to LeRoi Gasoline engines with panels, etc.
All above equipment actually in stock. Send for our list of many other items we have.

KEYSTONE
Power Plant Equipment Company

8403 Hegerman St. — Phila. 36, Pa.

POWER EQUIPMENT

INSPECTION INVITED

IMMEDIATE DELIVERY

DIESEL ENGINES

General Motos 900 HP Model 12-567, 2 cy. 12 cyl. 744 RPM with Falk reversing and reduction gear, ratio 2½ to 1. Electric starting. Auxiliaries available.

DIESEL GENERATORS

100 KW DC 240/120 V., 417 Amps., 1200 RPM. Motor: Superior, 150 HP Model GDB-8, 8 cyl., Electric Starting. Auxiliaries Available.

TURBO-GENERATORS

132 KW. AC, GENERAL ELECTRIC, Generator: 450 & 220 V, 3 Phase, 60 cycle, 1200 RPM. 275 Amps. Exciter: 40 KW. DC. 120 V. 22.6 Amps. Reduction Gear: 10071 to 1200 RPM. Turbine: 172 KW. Condensers available.

60 KW. DC. WESTINGHOUSE, Generator: 120 V. 1800 RPM. 500 Amps. Reduction Gear: 7283 to 1800 RPM. Turbine: 60 KW. 89.4 H.P. Condenser available.

NUMEROUS OTHER ITEMS ARE AVAILABLE FOR INDUSTRIAL USE.

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WRITE PHONE

NORTHERN METAL CO.

MILNOR & BLEIGH STS. —SHIPBREAKERS— PHILA. 35, PA.

PHONE: MAfair 4-1400

FOR SALE

New Chrysler Diesel Power Units

75 HP Model IND-3, 6 cyl., Elec. Start, Includes 4 batteries, Radiator, Spare Parts and Twin Disc Clutch.

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Caterpillar Diesel Power Unit

Model D13000 6 cylinder, 4 cycle, 900 RPM, 5¾" x 6", including clutch. Rebuilt.

• • •

Caterpillar Model D 50 Tractor

#1E185, LaPlante-Choate, straight blade, BD 50-28, single action, overhauled, excellent condition.

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ALJOHN DIESEL CO., INC.

904 Pacific St. Brooklyn 16, N. Y.
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CENTRIFUGAL PUMPS

Rebuilt and Guaranteed

2—Warren 20"x16", Size 20, Type 16DL 8500 GPM, 45' Head, complete with 125 HP 440/3/60 870 RPM Motors.

1—Dayton-Dowd Type CSLH 10"x10", 2000 GPM, 118' Head, complete with 75 HP 440/3/60 1800 RPM motor.

1—Dayton-Dowd, Type CSLH 10"x12", 3000 GPM, 130' Head, complete with 125 HP 440/3/60 1800 RPM motor.

2—Dayton-Dowd, Type CSLH 12"x14", 5000 GPM, 130' Head, complete with 200 HP 440/3/60 1800 RPM motor.

3—Goulds All Bronze 4"x3" 2-stage 400 GPM 150' Head 1750 RPM, 25 HP 1750 RPM motor.

1—Allis-Chalmers Type S all Bronze 6"x5" 1000 GPM, 230' Head, 100 HP 1750 RPM motor.

C & S MACHINERY CO.

715 Howard St. St. Louis 6, Mo.

TURBO-GENERATORS

200 KW. TO 5000 KW.

NEW-USED
RECONDITIONED

J. PARKER THOMPSON CO., INC.
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100 H.P. AMES ECONOMIC
ASME 125 LB. PRES. BOILER
60 FT. STACK & GRATES

DARIEN CORP.

60 E. 42nd St. N. Y. 17, N. Y.

COMPLETE POWER PLANTS

STEAM-ELECTRIC-HYDRO-DIESEL

"Export Orders Carefully Executed"

BOILER UNITS

2—135,000# Steam Generators 450# or 200#
2—60,000# Steam Generators 450# or 200#
2—50,000# Steam Generators 450# or 200#
4—1000 HP Heines with superheat 200#
2— 825 HP B&W Co. Stirlings, Super, 200#
2— 500 HP B&W Co. Stirlings, 160#
2— 600 HP B&W Co. Sectional, Super 350#
2— 450 HP B&W Co. Sectional header 200#
3— 310 HP Stirlings 180#

FIRE TUBE BOILERS—Various Types and Sizes
TRANSFORMERS, M-G SETS

OUR EXPORTS

have included several complete POWER PLANTS, Complete Boiler Plants, Complete Turbo-generator Plants, many Boilers, Turbo-generators, Transformers, etc., Shipped to Porto Rico, Cuba, Mexico, Brazil, Peru, Argentina, China and other Countries.

TURBO-GENERATORS

1—6000 KW Unit Condensing 235#
1—5000 KW Unit Condensing 235#
2—5000 KW Units Condensing 200#
1—4000 KW Unit Condensing 200#
2—2500 KW Units Condensing 200#
2—1500 KW Units Condensing 200#
2—1250 KW Units Condensing 200#
Several 1000 KW, 750 500 KW Cond.
Non-Cond. 300-500-750-1000-1500-2000-2700 KW

FREQUENCY CHANGERS—600, 1250 & 1500 KVA.

CHARLES B. REARICK 30 CHURCH ST. NEW YORK 7

WE OWN FOR IMMEDIATE DELIVERY

THYLOX LIQUID PURIFICATION PLANT
Cap. 60 million cu. ft. per 24 hrs. Complete. Like new.

GAS PURIFICATION SYSTEM
2,000 to 16,000 cu. ft. per hour.

BLOWERS
4—18000 CFM 7¾" SP, V-Belted Type SE, No. 12 American.
6—10000 CFM 1.9" SP, Everdur Blades, Type R. Buffalo.
1—5750 CFM 7½" SP, American.
3—3300 CFM ¾" SP with Motors.
6—1200 CFM 13.9" SP with Motors.
3—1000 CFM ⅜" SP with Motors.

PUMPS
Chicago 4"x4" 500 GPM 88' H., C.I.
Allis Chalmers 2½" x 2" 200 GPM 140' H.
F.M. 3"x3" 300 GPM 100' H.
Deming, bronze 3"x2" 150 GPM 50' H.
Duriron 4"x3" 290 GPM, 90' H.
Duriron 3"x2" 300 GPM 108' H.
Wilfley S.S. 3"x2½" 150 GPM 100' H.

AIR COMPRESSORS
8—C.P. 12" x 10" NSB, 266 CFM, 100 lb. pressure.

WELDERS
300 and 400 amps. G. E. and Hobart 3/60/220/440, rebuilt & guar. New 1943.

AIR CONDITIONING UNITS
2—NEW CHRYSLER AIRTEMP units 75 ton complete with Trane Evaporative Condensers, Fans and Motors.
1—20 ton, Frigidaire

BUCKET ELEVATORS
46' centers, single 3½"x6" pitch chain, 7"x5" Buckets, steel encased with drive.
48' centers, single 825 chain, 14"x7" MI Buckets, steel encased.
68' centers, single 825 chain, 10"x6" MI Buckets, steel encased.

MOTORS
Large quantity NEW Gear Motors and X.P. from ½-75 H.P. available immediately.

BOILER PLANT
Complete plant, Erie City, 604 HP, 180 PSI, ASME code and Natl. Board. Pulverized coal fired, with coal bin bucket elevator.

DIESEL GENERATOR SETS
3—G.M. Model 6-71RC, 1200 RPM, 6 cylinders, direct connected to 75 KVA Generators 3/60/127-220, complete. New 1945. Only used 100 Hours. Guaranteed condition
3—G. M. Model 8-268A, 1200 RPM, 8 cyl., direct connected to 300KW D.C. Generators 120/240, comp. New 1942-3.
1—G. M. Model 3-268A, 1200 RPM, 3 cyl. direct connected to 100KW D.C. Generators 120/240, comp. New 1942-3.
5—Superior Model GDB-8, 1200 RPM, 8 cyl., direct connected to 100KW D.C. Generators 120/240, comp. New 1942-3.

TRANSFORMERS
10 KVA G.E. 2400-240/480
25 KVA West. 450-117 air cooled. (10)
37½ KVA G.E. 4600-2300 (3 avail.).
100 KVA West. 4160-208/120, 3 phase.
200 KVA G. E. Pyranol 2400-4160Y/240-120.
200 KVA G. E. Pyranol 2400-4160Y/240-480.
500 KVA West. 4160-480.

Heat and Power Co., inc.

70 PINE STREET | DIGBY 8-0373 | **NEW YORK 5, N. Y.**

IMMEDIATE DELIVERY

HARD-TO-GET ELECTRICAL EQUIPMENT – NEW!

NEW SLIP RING MOTORS

All 220/440 Volt

Qu.	HP	Speed	Mfg.
1	100	900	Elliott
1	100	720	Elliott
3	125	720	Elliott
2	150	720	Elliott
*1	250	900	G.E.
2	500	1200	Elliott

*Used—Reconditioned

New C-H semi-magnetic controls for above in stock.

NEW MAGNETIC SLIP RING CONTROLS

16—250 HP, 440 volt (125 HP, 220 volt) Allis reversing and plugging with air ckt. breaker, speed regulating or auto. acceleration.

NEW GEARHEAD MOTORS

All 220/440 Volt

Qu.	HP	Output	Frame	Mfg.
1	1	125	204	Stlg.
1	1	350	204	Stlg.
1	2	45	225	Stlg.
2	2	125	254	U.S.
1	2	230	224	Stlg.
7	3	45	254	Whse.
4	3	350	225	Whse.
8	5	41	254	Whse.
4	7½	25	324	U.S.
1	10	20/60	324	Stlg.

NEW M-G SETS

25—Reliance 7½ VS (6KW) 380/440—50/60 with var. voltage D.C. (275 max.) belt driven exciter.

NEW D. C. CONTROLS

50—5 to 150 HP, 230 D.C. with and without FA relays.

NEW D. C. MOTORS

All 230 Volt

Qu.	HP	RPM	Frame	Mfg.
5	5	1750	23 T	Rel.
5	10	1750	34 T	Rel.
8	10	515/1750	78 T	Rel.
5	35	850	230 T	Rel.

Reconditioned - Guaranteed

3	15	400/1600	131 T	Rel.
1	20	500/1500	193 SK	Whse.
1	25	300/1200	153 SK	Whse.
2	40	500/1500	SK	Whse.
2	75	500/1500		C W
2	100	500/1500	183 SK	Whse.
1	125	600/1800	1050 T	Rel.
1	250	275/690		G.E.

NEW REDUCERS

5—Falk 5 HP, 28DU, 10:1
5—Falk 10 HP, 32DU, 10:1
1—Abart 12 HP, 6 A, 18.5:1
2—Foote 15 HP, 60DX, 10:1

The Boswick Electric Co.

P. O. Box 55, Akron 9, Ohio ***Telephone Walbridge 1195***

SEARCHLIGHT SECTION

SLIP RING MOTORS

3-Ph., 60 Cy.

HP	Volts	Make	Speed
450	440/220	Whse.	514
300	440/220	G.E. MTC	600
200	2200/440	G.E.	1200
200	440	G.E.	450
150	440/220	Whse. (2)	1800
150	2200/440	G.E.	1200
125	440/220	G.E.	600
125	440/220	G.E. (Hoist)	900
100	2200/550	G.E.	1800
100	440/220	G.E.	1200
100	2200/550	G.E.	1800
80	440/220	G.E. (MTC)	900
75	2200/550	G.E.	1800
75	440/220	Whse. 25 cy.	750
50	440/220	G.E.	900

SYNCHRONOUS MOTORS

3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
250	440/220	Whse.	HH	277
250	440/220	G.E.	ATI	600
240	440/220	Whse.	G	1800
200	4150/2300	Whse.	G	1800
150	4150/2300	G	G	1800
125	440/220	Whse.	G	1200
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	440/220 (new)	Whse.	G	1800
75	2200/440	Whse.	GE	600

TURBO-GENERATOR

Generator, 62½ kva, 1200 rpm, 440/220 volt, Whse. direct connected through reduction gear to Turbine, 50 kw, 7300 rpm, non-condensing, 125/150 lbs. gs., pr.

AIR COMPRESSOR UNIT

1—13" and 8" by 10" Worthington FEATHER-VALVE. 285 rpm. 110 lbs. gs. motor-driven.

CIRCUIT BREAKERS

1—5000 amp., ITE., 3 pole, 600 v., air
2—2000 amp., G.E. E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse, 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
700	2300	Whse.	CS	1800
500	440/220	G.E.	IK	900
400	550	G.E.	IK	720
350	2200/440	Whse.	CS	600
300	2200/440	Whse.	CS	600
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
200	440/220	G.E.	TEFC	1800
200	2200/440	G.E.	KF	720
200	2200/550	Cr. Wh.	uC	900
200	2200/440	G.E.	KT	1200
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
125 vert.	440/220	G.E.	KTP	1200
100	550	Cr. Wh.	Q	900
100	440/220	G.E.	KT	450
100	2200/440	G.E.	K	1200
100	2200/550	G.E.	KT	900
75	440	G.E.	KT	400
60	440/220 (new)	L. Allis	OGA	1800

A. C. GENERATORS

1—320 kva., 600 rpm., 440/220 v., G.E.
1—225 kva. 600 rpm., 220/440 v., G.E.
1—150 kva., 1800 rpm., 2200/550 v., Whse.
1—112 kva., 900 rpm., 440/220 v., G.E.
1— 98 kva., 1800 rpm., 440/220 v., G.E.
2— 75 kva., 1800 rpm., 440/220 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
200	230	Cr. Wh.	CMC	890
150	230 (new)	Cr. Wh.	TEFC	900
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230 (new)	Whse.	SK	1150
75	230	Whse.	SK	850
75	230	Whse.	SK	1750

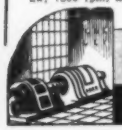
MOTOR GENERATOR SETS

1—165 kw, 1200 rpm, 240 v., G.E., conn. to 250 hp, 1200 rpm, 440/220 v., squirrel cage
1—150 kw, 900 rpm, 240 v., Cr. Wh., conn. to 225 hp, 900 rpm, 2200/550 v., squirrel cage
1—100 kw., 250 v., 900 rpm., Cr. Wh., conn. to 150 hp., 440/220 v., sq. cage.
1—75 kw., 125 v., 1200 rpm., G.E. conn. to 129 hp., 2200/440 v., syn. motor.
1—50 kw., 250 1200 rpm., G.E. conn. to 75 hp., 440/220 440/220 v., 60 cy., G.E. syn. motor.
1—50 kw., 250/1200 rpm., G.E. conn. to 75 hp., 440/220 v., 60 cy., syn. motor.

TRANSFORMERS

60 Cy.

3—2000 kva., G.E., 25000-2300 volts.
1—1000 kva., Al. Chal. 2400-120/240/208 volts, 3 ph.
1— 400 kva., G.E., 2300-230/115 v.
3— 300 kva., G.E., 13800/6900-115/230/460 v.
3 —200 kva., Moloney, 2400-240/480 v.
3— 200 kva., G.E., 4800/2400-120/240 v., 1 ph.
2— 150 kva., G.E., 13800/6900-110/220 v.
1— 150 kva., Whse. SK, 13200-125/215 v., 3 ph.
6— 100 kva., G.E., 4600/2300-230/115. NEW.
3— 100 kva., G.E., 450-115/230 v., dry, 1 ph., new.



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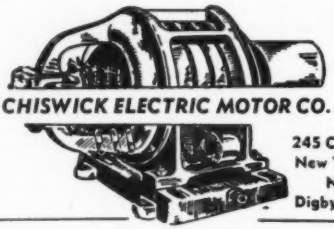
HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

MOTORS • CONTROLS • GENERATORS

Rebuilt Guaranteed Equipment in Stock

SIZES FROM 1 HP TO 250 HP



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245 Centre St.
New York 13,
N. Y.
Digby 9-1744

1—180 HP, Engine No. 653332, 3 cylinder, Type Y, Style VA, direct connected to **Allis-Chalmers** generator, 120 KW, belt driven exciter, 440 volt, 3 phase, 60 cycle. **Offered at $2800.00.**

3—200 HP, all the same series, Engine No. 596019, Type Y, Style V, direct connected to **Fairbanks-Morse** 170 KVA, 440 volt, 3 phase, 60 cycle generators, belt driven exciters—**$3800.00 each.**

PORTER ELECTRIC COMPANY
330 South Sixth St.
Minneapolis, 15, Minn.
LI 7531
ELECTRICAL EQUIPMENT COAST TO COAST

FOR SALE

25 Ton Locomotive Crane—Bargain
37 HP Steam Gen. Boiler—100/250# P.
20" Williams Hammermill—Motor Dr.
400 KVA 220/440 V. Gen. D/C Engine
109 &150 HP Kewanee Boilers—95% New
100, 125, 150, 250, 350 HP Motors—New & Used

H. & P. MACHINERY CO.
6719 Etzel Ave., St. Louis 14, Mo.

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500 HP 514 RPM, 3/60/440, Syn. & Panel GE
400 HP 600 " " " "
400 HP 900 3/60/2300 " " West.
300 HP 514 3/60/440 " " E-M
150 HP 900 3/60/2300 SQ. C. L-A
100 HP 300 3/25/440 SLIP " GE
200 HP & 50 HP MAGNETICS, NEW SURPLUS
300 KW SYN. CONVERTER, 25 Cycles, 600 V. DC, 750 RPM, GE, HCC, Auto. Panel & Trans. 13 KV.
150 KW DIESEL PLANT 3/60/2300, C-P, 400 RPM.
3—150 KVA OISC Trans. 3 PH. 50 Cy., Moloney 22-11 KV/3300, New Surplus
2—300 KVA DITTO
20 HP, DC 230 V., 3450 RPM, & Auto Starters
7½ HP DC 230 V. 1750 RPM TEFC Starters
2 HP GE TEFC, 3450 RPM, 3/60/220, XP
5 KVA & 3 KVA OISC Trans, 1 Ph., 4160/120-240

SAMUEL M. DAVIS
510 LaSalle St.
ST. LOUIS 4, MO.

FOR SALE

AIR COMPRESSOR

1100 cu. ft. 100# Chg. Pn. direct con. 215 HP Syn. Motor 2200/3/60.

MOORHEAD ELECTRICAL MACHINERY CO.
Mayflower 7900 Pittsburgh 19, Pa.

FOR SALE

1—100 HP—Hewes & Phillips—Carliss Engine—16 x 30E—right hand; 100 lbs. initial steam pressure, 5 lbs. back pressure, 100 RPM, good condition. Available January 15, 1949.

ZINSSER & COMPANY, INC.
Hastings-on-Hudson, N. Y.

REFRIGERATION UNITS

Fourteen Chrysler Airtemp Model 14-H Freon (F-12) 60 ton capacity "package" type refrigeration units. Each complete with 60 HP motor, two 7 cylinder direct connected radial compressors, Acme closed water chiller, two heat exchangers, automatic temperature and pressure controls. Each unit in steel frame, completely piped, weighs 14,000 lbs. Most units have 400 lbs. Freon. Units in first-class condition and on average operated only 505 hours. Suitable for refrigeration, air conditioning; food, oil, and chemical industries, etc. Original cost each unit approximately $11,000. Price only $2900 per unit F.O.B. Warehouse, Seattle, Washington.

JOHN S. COTTON
28 Brookside Drive, San Anselmo, Calif.
Phone San Anselmo 5921-J.

DIESEL-GENERATORS

5 KW. TO 1000 KW.

NEW-USED RECONDITIONED

J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK 17, N. Y.
MURRAY HILL 7-6547

A-C'S BUYING GUIDE TO—

GUARANTEED NEW AND REBUILT INDUSTRIAL ELECTRICAL EQUIPMENT

D. C. GENERATORS
(Reconditioned & Guaranteed)

Qu.	KW	RPM	Make	Description
5	20	1200	G.E.	CD93
2	75	1200	C-W	53H
1	30	1200	G.E.	CD113
9	5	1200	Rel.	23T

MOTOR GENERATOR SETS
(Reconditioned & Guaranteed)

Qu.	KW.	D. C. Volts	A. C. Volts
25	3	250	220/440-3-60
5	5	250	220/440-3-60
1	30	125	220/440-3-60 (new)
1	60	125	220/440-3-360 (syn)
2	75	250	220/440-3-60
1	100	125/250	220/440-3-60
1	100	250	220/440-3-60 (syn)
1	125	250	2300-3-60
1	150	250	220-3-60

CONTROLS (New)

Qu.	Size	Mfg.	Volts	Type
18	1	C-H	220-440-550	Combination
28	2	C-H	220-440-550	Combination
20	3	Clark	440-550	Combination
3	4	C-H	440	Combination
25	2	C-H	220-440	Reversing
3	3	Sq. D	440	Reversing
4	4	C-H	440	Reversing

SLIP-RING AND SYNCHRONOUS MOTORS
(Reconditioned & Guaranteed)

1—**106 KW**, 1200 RPM **Electric Machinery** synchronous generator, 80% PF, 220/440-3-60, single bearing.

1—**125 HP**, 277 RPM, **General Electric** synchronous motor, 100% AF, 220/440-3-60.

1—**250 HP**, 600 RPM, 2200 volt, 3 ph., 60 cy. **Lincoln** IXY slip ring motor.

2—**50 HP**, 900 RPM, 220/440-3-60 **Louis Allis** slip-ring motors, frame 505, Type GH, complete with fully magnetic control and resistance bank, like new.

REDUCED VOLTAGE STARTERS

Qu.	Size	Mfg.	Volts	Type
14	15 HP	C-H, G.E.	220-440	R & G
6	25 HP	C-H	220	Primary Resistor (new)
11	50 HP	C-H	220-440	New and R & G
4	75 HP	C-H	220	New
3	100 HP	C-H	440	New
4	125 Hp	C-H	220	New
2	150 HP	C-H	440	New
2	125 HP	C-H	440	Primary Resistor (new)

MISCELLANEOUS

AUTHORIZED DEALER

1—New Robbins & Myers 5000 lb. Type S 3 BG Hoist, complete with hand geared trolley and totally enclosed motor, lifting speed 32 FPM, pendant rope control.

1—Chandesson 5000 amp., 6 volt plating generator set with complete control, synchronous motor drive, 440-3-60.

1—60KW, 1500 amp., Anodizing M-G Set, 3/40 volts, Any AC voltage, 3 ph., 60 cy. squirrel cage drive.

1—Electro-Products 120 KW, 3000 amp. Anodizing M-G Set, 3/40 volts, with complete control and synchronous motor drive.

A. C. SQUIRREL CAGE MOTORS
220/440 v., 3 ph. 60 cy.
(New except where shown as "R & G")

Qu.	HP	RPM	Make	Description
1	150	1750	Al. Ch.	R & G
1	150	600	Westg.	CCL—R & G
1	125	1760	Al. Ch.	
1	125	1170	Al. Ch.	626 DB, SB
1	125	900	Al. Ch.	626 F
1	100	1760	Al. Ch.	623 AS, SB
2	100	1170	Al. Ch.	623 E
1	100	900	Al. Ch.	626 E, SB
1	100	720	Wstg.	CCL, 220 V, R & G
2	75	3500	Al. Ch.	4458, R & G
1	75	1750	Al. Ch.	5058, SB
1	75	1200	Al. Ch.	805, SB
1	60	1750	Al. Ch.	4448
1	60	1760	Al. Ch.	SB, R & G
1	50	3450	Ideal	A 120
6	50	1750	Al. Ch.	445
2	50	1200	Rel.	445
1	50	900	Al. Ch.	505

D. C. ADJUSTABLE SPEED MOTORS
230 VOLTS (Reconditioned & Guaranteed)

Qu.	HP	RPM	Make	Description
7	15/20	400/1200	G.E.	CD105
3	7½/10	450/1800	G.E.	CD85
4	10/15	400/1600	G.E.	CD95
3	40/50	250/1450	G.E.	CD1441
2	50/60	300/900	E-D	308
4	60/75	450/1800	G.E.	CD1441
1	135/175	450/1200	G.E.	MCF
1	200	300/900	Wstg.	

D.C. CONSTANT SPEED MOTORS, 230 VOLTS (Reconditioned & Guaranteed Except Where Shown "New")

5	5	320/534	G.E.	CD93
13	3	850/1700	Rel.	23T
1	30	850	Rel.	New
1	75	1330/1760	Rel.	353T

The A-C SUPPLY CO.
P. O. BOX 991
AKRON, OHIO
Plant & Office Cuyahoga Falls, O.
Telephone (Akron) WAlbridge 1374

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6—**250 KVA. Westinghouse**, 1 phase, 60 Cy., OISC., out-door, 22000/21450/20900/20350/19800 volts primary to 2300/4000Y volts secondary. (If connected for 11,000 volts primary there are taps to 10450/9900.) #1218021-1218022-1061478-79-80 & 83.

3—**200 KVA., Gen. Elec.**, 1 ph., 60 Cy., OISC., out-door, 22000/21450/20900/20350/19800 volts primary to 2300 volts secondary, #2531471-2531472 & 2726448.

4—**75 KVA., Gen. Elec.**, 1 ph., 60 Cy., Type H, Form KR., OISC, Out-door, 13200/12540/11880 volts primary to 440 volt secy., #4999501-03-05 & 07.

3 PHASE

1—**200 KVA., Gen. Elec. Pyranol**, 3 Ph., 60 Cy., 575 volts prim. to 230 volts secy., Type HT, Form RA., #5597297, OISC, Out-door.

All the above transformers are ready for immediate delivery.

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(Inc. 1917)
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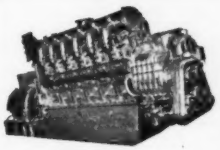
Tel.—BOwling Green 9-9275—9276



DIESEL Generator Plants
For Immediate Delivery

HEMCO

1000 KW, 2400 Volts, 3 Phase, 60 Cycle, 720 RPM, General Motors Model 16-278A.
750 KW, 2400 Volts, 3 Phase, 60 Cycle, 720 RPM, General Motors Model 12-567.
600 KW, 2400 Volts, 3 Phase, 50 Cycle, 600 RPM, General Motors Model 12-567.
300 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A.
200 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A.
50 KW, 440 Volts, 3 Phase, 60 Cycle, 900 RPM, Fairbanks-Morse Model 36A 5½.
100 KW, 3 Wire, 125/250 Volts DC, 1200 RPM, General Motors Model 3-268A.
900 HP, General Motors Model 12-567, Propulsion Unit Complete.

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.1 MFD	25 KV	9.85
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KVA	Volts	Engine	HP	Cyl.	Mod.	Price
90	2300/220	F & M	120	2	32	$4,250
200	2300/440	F & M	240	4	32	7,200
200	2300/440	F & M	240	4	VA	6,000
300	2300/440	F & M	360	6	32	9,000
300	2300/440	F & M	360	6	VA	6,750
100	220	Fulton	135	4	L	2,700

ENGINES

HP	Mfg.	Cyl.		Model	Price
130	Caterpillar	6	Diesel	D-13000-H	$3,700
130	Caterpillar	6	Diesel	D-13000-S	4,250
135	Murphy	6	Diesel	ME-6	2,850
170	Caterpillar	8	Diesel	D-17000	5,250
200	Buda	6	Diesel	D-1742	3,500
200	Buda	6	Nat. gas	D-1742	2,750
180	Buda	6	Nat. gas	JL-1335	2,500
80	F & M	4	Marine Diesel	34-B	1,000
56	International	4	U-9		950

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Immediate Delivery

4—Fairbanks Morse O. P. MOD 38D8⅛—1600 HP direct connected to Crocker Wheeler 1250 KVA—1000 KW—3 PH—60 CY—2300/4000 Volt—720 RPM Alternaters with 10 KW direct connected Exciters.

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2—General Motors MOD 3-268A—150 HP direct connected to Delco 100 KW—120/240 Volt, 1200 RPM 3 wire DC Generators.

ALCO (McIntosh & Seymour) 900 HP type 6—12½ x 13—T, direct connected to GE-620 KW, 240 volt D. C.—700 RPM generators with direct connected exciters.

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1—2500 KW 3/60/2300 G. E. condensing turbo-generator 165 P.S.I. (can be changed to 400 P.S.I.). Complete auxiliaries.
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1—750 KW 3/60/2300 G. E. condensing turbo-generator 165 P.S.I. Complete auxiliaries.
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2—150 KVA. 60 CY. 1 PH. 2400-240/480 SCOTT TAPS.
6—100 KVA. 60 CY. 1 PH. 2400-240/120.
6— 75 KVA. 60 CY. 1 PH. 2400-240/120.
9— 50 KVA. 60 CY. 1 PH. 2400-240/120.
7—37½ KVA. 60 CY. 1 PH. 2400-240/120.
8— 15 KVA. 60 CY. 1 PH. 2400-480/240.

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These regulators are two years old. They have been in use two years and have been under cover all that time. They are as good as new.

Price F.O.B. Elk River, $2,100.00 each. Will give a crew to help load only

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Primary Volts	Load Amperes	% Rise	% Lower
2400	400	5	5
2400	200	10	10

Approx.—Total weight, 2480 pounds. No. 10—C oil—61 gallons.

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Skinner Uniflow engine, direct connected to 160KW, 220 V, 3 Ph generator, with exciter.

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165 HP Stirling boiler, stack, fan and Firite spreader stoker.

304 HP Vogt (4 drum) boiler, stack, fan and Firite spreader stoker.

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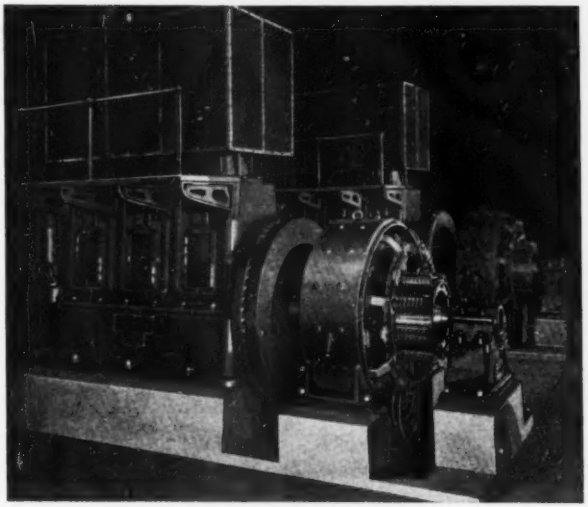

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800 KW capacity

250 volt direct current

(A. C. GENERATOR CAN BE SUPPLIED)

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2—400 KW, 40° General Electric 1600 Amp. 2-wire, 250 volts, 360 RPM Type LDR, Form A, compound wound interpole direct current generators direct connected to:

2—640 HP Skinner Vertical 360 RPM, 3 cylinders, 15" diameter by 14" stroke right-hand Unaflow non-condensing engines, operated at 140 to 160 P.S.I.G. 0 to 10 lbs. gauge back pressure and designed for a maximum of 185 P.S.I.G., 15 to 20 lbs. gauge back pressure.

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4000 KW TURBINE GENERATING PLANT

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1—2000 KW and 2—1000 KW General Electric, 3 phase, 60 cycle, 480 Volts, 3600 R.P.M. Condensing Turbo Generator Units. Complete with all Auxiliaries. General Electric inspection reports are available.

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7 —	1 HP	100 rpm
3 —	1 HP	190 rpm
10 —	1 HP	280 rpm
2 —	2 HP	16.5 rpm
4 —	2 HP	37 rpm
10 —	2 HP	190 rpm
2 —	2 HP	230 rpm
9 —	3 HP	45 rpm
3 —	3 HP	190 rpm
3 —	3 HP	350 rpm
2 —	5 HP	155 rpm
8 —	5 HP	230 rpm
6 —	7½ HP	13.5 rpm
6 —	7½ HP	420 rpm
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750 gpm, steam operated, like new.

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115 KVA Wghse. 2400/480 v.—Sturtevant
62.5 KVA GE 240/480 v.—DeLaval
62.5 KVA GE 480/240 v.—Terry 310#

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1250 KVA General Electric 2300 v.
1250 KVA (2) Al. Chal. 4000/2300 v., 300#
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3500 sq. ft. Wheeler

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375 KVA FM "32E-14"; 480/240 v.
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37½ KVA (3) General Motors 220/440 v. (NEW)

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125 HP (2) Scotch Marine 100#
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102 HP Ames (Economic) 125#

STEAM ENGINE SETS, A. C.

1125 KVA GE 480/240 v.—Nordberg Unif.
400 KVA GE 2300/480 v.—Erie City poppet v.
312 KVA GE 2300/480 v.—Chuse 4 v.
210 KVA GE 480/240 v.—Skinner
187 KVA GE 480/240 v.—Chuse 4 v.
187 KVA GE 2300 v.—Chuse 4 v.
150 KVA GE 240 v.—Skinner

STEAM ENGINE SETS, D. C.

600 KW Wghse. 250 v.—Skinner Uniflow
300 KW GE 250 v.—Skinner Uniflow
300 KW CW 125 v.—Skinner Uniflow
200 KW GE 125 v.—Skinner Uniflow
150 KW GE 125 v.—Skinner Uniflow
150 KW CW 250 v.—Ames Uniflow Vertical

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Three 400 KVA Wghse. 2300-230/460 v.
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New Package Steam Generators—Fully automatic.
Designed to use light or heavy oil or gas.
Complete with all auxiliaries—Ready to install.
Sizes 30 to 250 H.P.—Steam Working Pressures—15#—100#—125#—150#—Delivery early 1949.
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PARKE PETTEGREW & SON CO.
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NEW WORTHINGTON 20-1 200 GPM Centrifugal Pump and Moore Turbine
THE J. C. LYSLE MILLING CO.
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Complete dead front slate switch-board
3300 KW, 2300 volt. 14 street lighting, distribution and generating panels.
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3—Standard Iron Fireman Stokers, #3 Regular Equipped with Westinghouse Class 1, 1½ H.P. 220-440 V. Motors, Model C-200 Controllers and ½ ton hoppers. Good Condition—Contact C. F. Murray or G. G. Hengst at Fairchild Aircraft Div. Hagerstown, Md., Tel. 3600, Ext. 256 or 562.

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1250 KW. TURBO GENERATOR

FOR SALE
Cast steel, 10 stage, 200 to 300 lbs. pressure 3/60/2300 v. 3600 RPM. With Surface Condenser. Used 6 years, dismantled.
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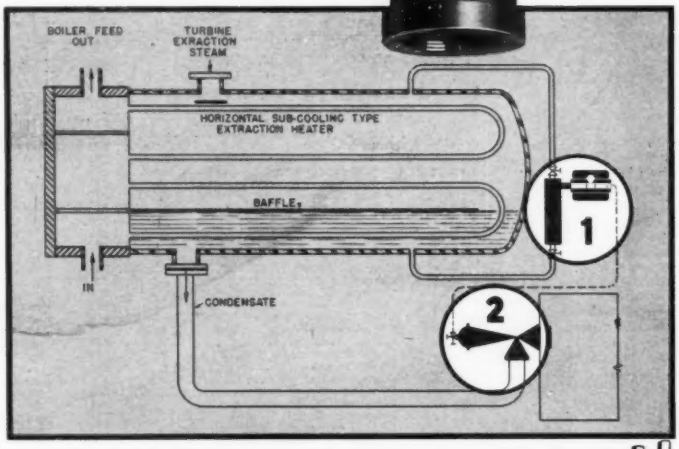
Swartwout Type L-1 Liquid Level Control

Your need for positive, accurate liquid level control on all important liquid-containing vessels is met by Swartwout Type L1 Control. On horizontal sub-cooled heat exchangers, for instance, efficient operation calls for levels held within very close limits *from no load to full load.* Type L1 maintains levels *within one half inch* in all types of heaters, under all load conditions. Its smooth operation compensates for quick-changing loads or long process lags, eliminating all tendency to cycle or hunt.

Action of the Swartwout Liquid Level Control is frictionless; the construction leak-proof without the use of stuffing boxes. Its most important features are short float travel, sensitive torque-tube translation of float action, automatic reset and set-back load compensation, and rugged simplicity. . . . To obtain the full efficiency of your heater or other liquid-handling vessels, install Swartwout Type L1 Controls. Write for Bulletin S-15-A.



Here's an example of a horizontal sub-cooled heat exchanger hookup where (1) Swartwout Type L1 Liquid Level Control keeps condensate level where it performs its proper function — never allows it to cover tubes that should be normally steam heated. (2) Swartwout V10 Regulating Valve especially designed to stand the punishment of flashing condensate. Unique angle body, disc and seat design give it long years of dependable trouble-free service. Data Unit S-208A describes it.

Swartwout POWER PLANT EQUIPMENT

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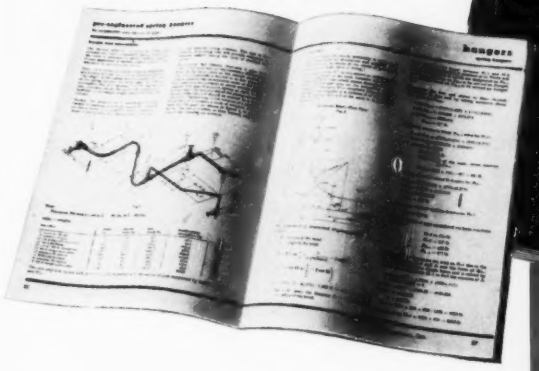

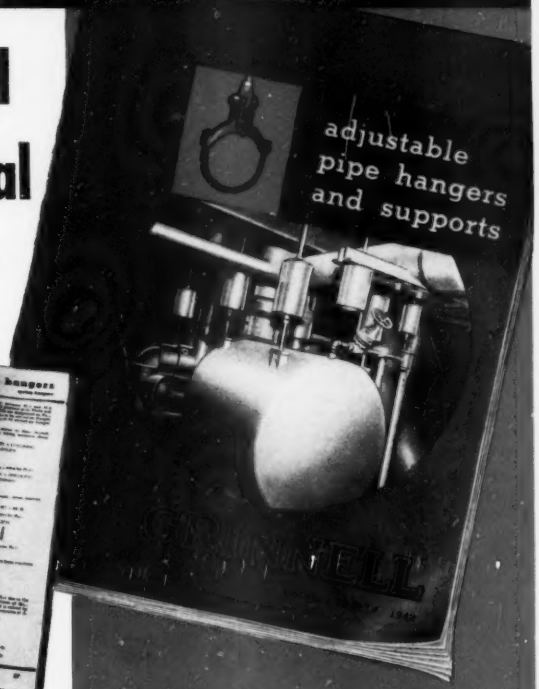

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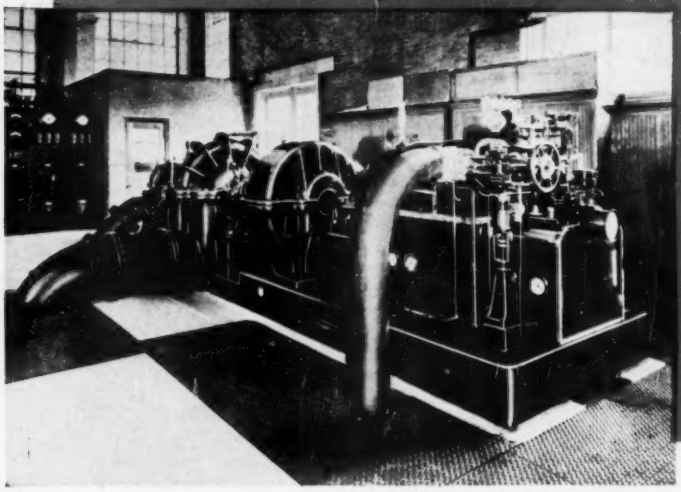

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